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[OFFICIAL NOTICE.]

First Annual Meeting, Canadian Gas Association.

OFFICE OF SECRETARY-TREASURER,
CANADIAN GAS ASSOCIATION,
WOODSTOCK, ONT., May 11th, 1908.

To the Members of the Canadian Gas Association: Gentlemen—The first annual meeting of the Canadian Gas Association will be held in Toronto, Friday and Saturday, June 26 and 27, 1908. Papers are in the course of preparation and announcement of the titles will be made later. Arrangements are in the hands of an Entertainment Committee for the entertainment of delegates, outside of the business meetings. There will be trips of interest, including a visit to the large, modern plant of the Consumers Gas Company, and to various points in the city. The business meeting will be held in the King Edward Hotel. It is suggested that reservations be made at as early a date as possible. Please advise me if you expect to be present. Yours very truly,

A. W. MOORE, Secretary-Treasurer.

[OFFICIAL NOTICE.]

Fourth Annual Meeting of the Iowa District Gas Association.

IOWA DISTRICT GAS ASSOCIATION,
OFFICE OF SECRETARY,
DES MOINES, IA., May 23, 1908.

The fourth annual meeting of the Iowa District Gas Association will be held at Hotel Rome, Omaha, Neb., June 17th, 18th and 19th, and will be called to order at 10 o'clock, A.M., by the President, Mr. Jansen Haines, of Des Moines, Ia.

The Hotel Rome is prepared to accommodate 100 guests for this meeting, to furnish a room suitable for the sessions of the Association, and announces the following rates:

European plan, rooms without bath	$1.50 and $2
Rooms with bath	$2.00 to $4
Double-bedded rooms, with bath	$3, $4 and $6

As more satisfactory arrangements can be obtained by securing rooms in advance of the meeting, members are requested to do so.

The following papers have been promised:

"The Delinquent Account," by A. W. Borden, Hastings, Neb.

"Attention to Consumers," by Thomas Crawford, Clinton, Ia.

"The Hygiene of Burning Gas," by J. C. Gray, Des Moines, Ia.

"The Gas Manager's Relation to the Public and to the Employees of His Company," by W. E. Davis, South Omaha, Neb.

"Comparative Value of Fuels Available in the Iowa District," by Homer Honeywell, Lincoln, Neb.

"Bookkeeping of a Small Gas Company," by Geo. S. Forest, Iowa Falls, Ia.

"Three Methods of Disposing of Our Tar Products," by Wm. H. Taylor, Jr., Omaha, Neb.

"Boilers and Boiler Compounds," by C. N. Chubb, Sioux Falls, S.D.

The "Wrinkle" Department will be conducted by H. D. Mitchell, St. Charles, Mo., and all members who have not already sent in a contribution should do so at once. The Council also announces the following topics for general discussion:

"Leakage." "Fire Protection." "New Business."

There will be a resuscitation drill by team of employees of the Omaha Gas Company. The Committee on Arrangements announces the following entertainment:

Wednesday evening, June 17th—Initiation into the Knights of Ak-Sar-Ben.

Thursday evening, June 18th—Annual banquet at Hotel Rome.

Friday afternoon, June 19th—Trolley ride.

G. I. VINCENT, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, American Gas Institute.

To the Members of the American Gas Institute: All members of the Institute are earnestly requested to send in as soon as possible contributions for this year's Wrinkle Department report. The success of the Department depends entirely on the co-operation and assistance of the members.

Mail all contributions to Milan R. Bump, Edit[illegible] New York city.

JUN 8 1908

BRIEFLY TOLD.

RATIFICATION OF THE AFFILIATION OF THE WISCONSIN GAS ASSOCIATION WITH THE AMERICAN GAS INSTITUTE.—By virtue of the following notice, signed by President A. C. Humphreys, issued from the headquarters of the American Gas Institute the 29th ult., the affiliation of the Wisconsin Gas Association with the American Gas Institute is completed and acknowledged:

To the Members of the American Gas Institute—The Wisconsin Gas Association, having complied with the requirements of the Constitution of the American Gas Institute, an agreement of affiliation between the Institute and the Association has been executed, and Mr. Sheldon J. Glass has been appointed as the Association's representative on the Institute Board.

AN INSTRUCTIVE CATALOGUE.—Catalogues issued by houses whose trading operations are large are usually instructive, in that the text thereof is usually concise and clearly put, and that the description is well supplemented by illustrations in every sense germane to the text. All of which expression is traceable to the fact that this morning's mail brought us a copy of the Brown Hoisting Machinery Company's new Catalogue, which is rather oddly marked "O." Its pages are altogether given over certainly, and properly, to descriptions of machinery necessary to the better working of the plants of artificial gas companies in which large quantities of heavy matters are being constantly handled, such as coal, coke, purifying materials and the like. That such handling may be well and economically done requires the aid of machinery, and it is the latter that the Brown Hoisting Company has for sale. To some no doubt this will read like an advertisement, but it is not. The Brown folks don't pay one cent for it, and the reference is here made simply in the thought that a look over the Catalogue may possibly induce the owners and managers of either large or small works not well provided with hoisting appliances to look into the value and efficiency of each to them. If the examination arouses their interest, well then let the purchasers go where they will. But, to come back to the Catalogue *per se*. A striking thing in it is the illustrating of the large coal handling bridge which is being constructed by the Brown folks at the mammoth plant now in course of erection for the Consol dated Gas Company of this city at Astoria. Unless we mistake this is to be the largest coal-handling bridge crane in the world, for it has a length over all of 600 feet, and the main trolley which travels on the bridge operates a grab bucket up to the carrying of 6 net tons of coal. Other interesting things shown in the Catalogue's pages are locomotive cranes for the handling of coal, several examples of which are given; and a specimen of wagon truck crane, which is quite a novel and positively useful tool for handling pipe, etc., and in that respect it would seem adopted for transporting use in the crowded ways of a busy city. If you desire a Catalogue write to the Company at its headquarters, Cleveland, O.

CURRENT COMMENT.—

TURNING from catalogues to circulars, the last one issued by the General Gas Light Company, of Kalamazoo, Mich., is quite a self-assertive one, but one can excuse that, for the Company generally "makes good" as to its delarations. This circular has to do with "Humphrey Arcs" and "Tungsten Bulbs,', and in it the Company states that for the fall trade it will offer lamps yielding a lighting duty of 30 candles to the cubic foot, which means 480 candles per lamp on a consumption of 16 cubic feet of gas per hour. With gas at $1 per 1,000, and with electric current carried to six 80-candle power tungsten lamps, at 100 watts each, at 6 cents per kw. hour, the relative work is performed by the former at 1.6 cents per hour, as against 3.6 cents in the latter. That is also leaving out of consideration the cost of maintenance, which is put at 1 for gas to 3 for current.

THE proprietors of the Flint (Mich.) Gas Company have awarded to the Cleveland (O.) Gas Machinery Company a contract for the placing of a 24-inch ammonia concentrator for the recovery of volatile and fixed ammonia. Mr. B. C. Robinson finds that the gasholder, recently constructed largely through his foresight, is of great assistance in taking care of the increased and increasing output at this point, an advance that is really as much due to the way that Mr. Robinson and his men are conducting affairs as it is to the growth of the city, which latter fact is a persistently unmistakable one.

MR. HENRY G. EDMANDS has been elected Treasurer of the Kalamazoo (Mich.) Gas Company, vice the late Mr. David H. Haines. The new appointee has been in the service of the Company since 1902.

MR. WM. S. BODWELL, formerly with the Dedham and Hyde Park (Mass.) Gas and Electric Light Company, has been appointed Superintendent of the Bloomington (Ills.) works.

[No. III.]

Review of the Twenty-third Annual Report, Board of Gas and Electric Light Commissioners, Commonwealth of Massachusetts.

[Prepared for the JOURNAL by MR. H. THURSTON OWENS.]

The statistics going herewith exhibit a summary of the financial operations of all the companies in the State, compiled from the items relating to the manufacture and sale of gas for 1907, and showing the increase and decrease in money and percentage over the previous year.

In the table (p. 971) it is shown that the increase in income for gas sold by meter was only one-half of the percentage of increase of gas sold by meter expressed in feet; or 5.4 against 11 per cent. The figures for gas supplied to public lamps show almost the same results, 2.9 per cent. (money) against 6 per cent. (feet).

The amount received for residuals in 1907 was $586,761.60, against $561,474.76 in 1906, and $657,413.40 in 1903.

The fact has often been pointed out that gas companies would have to make greater efforts to hold and obtain new business by means of sale and maintenance of appliances. That this condition is a fact, and not a theory in Massachusetts, is well illustrated in the figures below.

	1905.	906.	1907.
Income.			
Rent of gas stoves and engines	$531.98	$155.89	$2,844.50
" " lamps	193.00	2,023.79	7,093.00
Total	$724.98	$2,179.68	$9,937.50
Expenses.			
Gas stove fixing, repairs, etc	$51,949.50	$81,224.93	$102,092.16
Lighting and repairing (gas lamps)	23,503.31	42,729.52	68,443.01
Total	$85,452.81	$123,954.45	$170,535.17

Increases in expenses are not usually signs of improvement, but in the case in point an increase of 60 per cent. in the expenses covering lighting and repairing gas lamps is one of the most commendable features of the year's results. The apparent decrease in cost of repairs and maintenance of works is covered by the new item "Renewal of Plant."

In the matter of wages, salaries and fees, the increases were not at all uniform, as will be seen by the following table:

	Percentage of Increase.
Wages at works	7.3
Wages of meter takers, clerical labor in distribution and salary on commissions of collectors	1.2
Directors' allowances	14 3
Salaries of officers	2 4
General salaries	9.1

The results shown in the last four items of the table, haw expenses, claims, bad debts and incidental expenses, give very gratifying results.

The conditions regarding make, output, etc., of coal gas are shown, by the tables presented, to be as follows:

With the exception of five companies more gas was made during the year ending June 30, 1907, than during the previous year. Four of these five companies bought more gas than was the case in the previous year, so that every company save one in Massachusetts handled more coal gas than in the previous year. The increase of gas made amounted to nearly 18 per cent., while the amount of gas bought shows the slight decrease of less than 2 per cent. The quantity of gas sold by meter increased over 11 per cent., and that for public lamps over 6 per cent. Twenty-eight companies showed a larger percentage of unaccounted-for during 1907 than in 1906; the largest being at Stoneham; 29.03 for 1907, and 29.98 for 1906. The Boston figures for these years were 3.69 and 1.52 per cent.

The gas unaccounted-for in Massachusetts in 1907 represents a value of over $600,000.

The three oil gas companies showed an increase of sales by meter of over 6 per cent.

The acetylene companies showed an increase of sales by meter of over 31 per cent., over half of this increase being represented by the sales of the two new companies.

The report includes a table giving a comprehensive statement for each plant as to prices and discounts. With the exception of six of the acetylene companies, the average price was less than the gross price for all companies for 1907.

	For Year Ending June 30, 1907.	Money. Increase.	Money. Decrease.	Per Cent. Inc.	Per Cent. Dec.
Income:					
For gas sold by meter	$8,716,559.36	452,690.25	.....	5.4	....
For gas supplied to public lamps	220,162.52	6,292.13	.....	2.9	...
For gas sold to other companies	233,274.43	39,572.69	....	20.4	...
From sales of coke	408,912.93	24,211.68	.....	6.2	...
From sales of tar	128,897.03	.....	5,587.09	....	0.4
From sales of ammoniacal liquor	48,951.64	6,662.25	.....	15.7	...
From rent of meters	6,241.36	631.16	.....	11.2	..
From rent of gas stoves and engines	2,844.50	2,688.61	.....	1,724.6	....
From rent of gas lamps	7,093.00	5,069.21	....	250.4	....
From public lamps other than gas lamps	16,490.72	274.98	.....	1.6	....
From other sources	55.25	30.25	.....	120.8	...
Total	$9,789,482.74	532,541.12	.....	5.7	....
Expenses:					
1. Coals	$1,615,772.49	190,790.03	.....	13.3	....
2. Enrichers	802,379.05	151,783.04	.....	23.3	....
3. Purifying materials	101,051.74	16,000.65	.....	18.8	....
4. Water	26,857.89	.....	1,552.84	....	5.7
5. Wages at works	692,818.31	47,445.73	.....	7.3	....
6. Repairs and maintenance of works	341,260.14	.....	58,926.61	....	17.2
7. Renewal of plant (new item)	52,067.43	52,067.43	.....	....	....
8. Apparatus and machinery	45,299.75	.....	6,450.79	....	14 2
9. Gas bought	736,691.44	16,325.22	.....	2.2	....
10. Wages of meter takers, clerical labor in distribution and salary or commissions of collectors	368,374.48	4,573.35	.....	1.2	....
11. Repairs, renewals and maintenance of mains and service pipes	288,424.31	1,120.20	.....	0.3	....
12. Distribution tools and appliances	59,895.68	7,176.65	.....	13.6	....
13. Repairs and renewals of meters	185,435.27	10,627.57	.....	5.8	....
14. Gas stove fixing, repairs, etc.	102,092.16	20,867.23	.....	25.6	....
15. Lighting and repairing (gas lamps only)	68,443.01	25,713.49	.....	60.1	....
16. Lighting and repairing, and materials used for other lamps	35,444.18	12,698.12	.....	56.0	....
17. Directors' allowances	15,804.62	1,988.81	.....	14.3	....
18. Salaries of officers	196,395.28	4,627.39	.....	2.4	....
19. General salaries	276,375.42	23,219.34	.....	9.1	....
20. Rent of offices	30,591.17	1,426.00	.....	4.8	....
21. General office expenses	191,355.26	3,731.51	.....	1.9	....
22. Taxes	630,790.33	49,194.02	.....	8.4	....
23. Insurance	47,085.32	7,238.75	.....	18.1	..
24. Law expenses	42,635.65	.....	11,727.05	....	26.8
25. Claims	22,957.49	.....	2,231.47	....	9.0
26. Bad debts	10,504.76	110.19	.....	1.0	....
27. Incidental expenses	11,027.48	.....	1,944.59	....	....
Total	$6,997,830.11	565,891.37	.....	8.7	....
Leaving an apparent profit on their gas business of	$2,791,652.63	.....	33,355.25	....	....
They have also received for interest, etc	38,666.43	13,495.38	.....	....	...
They have also received for rents, etc	117,209.63	.....	41,531.46	....	....
They have also received as profits from electric lighting	789,618.01	122,907.75	.....	....	....
Making a total of	$3,737,146.70	61,516.42	.....	....	....
From these receipts should be deducted:					
Interest on bonds and loans	$277,970.24	64,760.03	.....	....	....
Dividends	2,314,661.44	.....	136,009.56	....	....
Other items	610,838.05	.....	28,576.24	....	....
	$3,203,469.73	.....	99,825.77	....	....
Leaving a surplus for the year of	$533,676.97	161,342.19	.....	....	....

Comparing the average price received for 1907 with 1906, we find that in 19 companies the average price was the same for both years; in 10 it was higher and in 45 lower.

Analyzing these results further, we find these changes divided among the various kinds of companies, as follows:

Average Prices.	Straight Coal Gas.	Combination. Coal Gas and Electric.	Combination. Oil Gas and Electric.	Acetylene.	Total.
Same for both years	7	7	..	5	19
Higher 1907 than 1906	3	2	1	4	10
Lower " " "	27	13	2	3	45
New companies	..	..	..	2	2
Total	37	22	3	14	76

[Official Report.—Continued from Page 934.]

PROCEEDINGS, SEVENTH ANNUAL MEETING, WISCONSIN GAS ASSOCIATION.

Held in Milwaukee, Wis., May 14 and 15, 1908.

First Day—Afternoon Session.

The Vice-President called the meeting to order at 2 P.M., and opened the proceedings by

Introducing Mr. Edwin S. Mack,

in the following manner: We have the pleasure of having with us this afternoon a gentleman who has had perhaps as much to do with the preparation of the legal side of cases before the Railroad Commission of Wisconsin as any other man in the State. Mr. Edwin S. Mack is of the firm of Miller, Mack & Fairchild, of this city, who are counsel for a great many of the leading public utilities of the State, not only in the city but elsewhere; and, as I said before, I think we are fortunate in having Mr. Mack with us, for he is better equipped to give us such information as we require upon the subject of depreciation of which he has made a special study than anyone else with whom I am acquainted. [Applause.]

Response of Mr. Mack.

Mr. Mack—Mr. President and Gentlemen: The subject of depreciation has really come into the minds of those in charge of public utilities within comparatively recent years, and its place in the accounting system is, one may say, almost unfixed. There is as yet no settled basis of providing for it, and, as far as I have been able to see, it is only when matters of controversy come before the courts or commissions that direct attention is given to the subject, and a ratio is estimated or computed. The remarkable fact about this is that nobody conducting a business enterprise of importance, outside of the public utility companies, would think for one minute that his business was being safely or wisely conducted, if constant care were not given to the subject of depreciation. Most manufacturing enterprises either make a direct charge against their machinery and tools' accounts at the end of the year, or build up a corresponding reserve to cover the wearing out of the property, anticipating the necessity of superseding the property that is not covered by current maintenance. How it came about that this wise feature did not occur to public utilities companies, it is hard to understand. In the steam railway business the art is comparatively fixed. There is comparatively little superseding of apparatus before it is worn out, and the size of most of the larger companies is such that after reaching say, a certain level perhaps, where the property is in 60 or 70 per cent. condition, or even a little more, there is a continual need of replacing worn out property so that the current maintenance covers depreciation. The need of fixing the depreciation ratio has been strongly brought home to all of us through the requirements of the public utility law. The law provides specifically that a fund shall be kept in hand sufficient to provide the company with means to keep its property in a state of efficiency corresponding to the progress of the industry, which means that the company should have in its treasury money or securities, or means of obtaining money or securities, sufficient to replace property as it wears out or becomes superseded through new inventions. To my mind one of the greatest evils that has arisen, through the failure to take care of depreciation, has been the misconception in the public mind as to rates. Many public utility companies, and I am speaking not only of gas lighting companies but also of electric lighting companies, street railways and power companies, have been established by men whose chief interest was in getting the company into the community and having it built, and who gave little care to its sub-

sequent operation. As a result, rates were fixed on a basis that would show a return computed as net earnings from operation. That is, the gross earnings were computed, the operating expenses were computed, the taxes deducted and the balance considered as net earnings. When rates were adjusted and dividends declared as if operating expenses, including merely current maintenance and taxes, were all that was to be considered, these rates became widely known through the community. They established the standards to which the public was educated, as the companies began to do business. More than that, they established the standards on which dividends were declared, and thereupon citizens, both in and out of public office, felt that the dividends were too large, became imbued with the desire to see these rates reduced, and began direct attacks on the rates of the utility companies. The fundamental difficulty that we have to-day in dealing with the question of depreciation is that, with many companies, if any return on capital whatever is to be earned, involves an increase of rates; and as the public has already been educated to a scale of rates computed without allowance for depreciation, naturally the beginning of a practice of building up a depreciation reserve may seem to the public an imposition or perhaps an extortion. But, whatever may be the ultimate result of it, it is true in this case as in any other, that a question is never settled until it is settled right; and gas companies, or other public utility companies, will never be on a sound basis until their methods of accounting, their basis of charge, their system of management, all make allowance for this fundamental fact that the property is continually deteriorating, no matter how well it may be maintained against current breaks; and that, therefore, a fund for replacement as the property wears out or is superseded must be had in hand. The practical demonstration of the evils of not providing for depreciation, comes out in the present systems of valuation. Valuation is and must be had under the terms of the utility laws. I think there will be scarcely a manager of a company who will not be surprised to see how great the difference is between the value of his property based on reproduction value new and the value of the property in its present condition. Likewise, there will be very few companies in the State, if any, that will have in the treasury or available on the books, enough accumulated earnings to represent the difference between the value of the property new and the value in its present condition, much less a fund to represent the difference between the cost and the value of the property in its present condition. The general course of invention is to make for lower prices and for cheaper construction, and the plant that cost $100,000 twenty years ago can be replaced to-day by a better plant for less money. Now, in dealing with the subject of depreciation, first of all let us find out what the term means. The utility law uses the phrase "Depreciation Fund," but really depreciation is the cause and the fund that is had in hand had better be called "Reconstruction Reserve," because it is reconstruction to which this fund is to be devoted. The elements that make it necessary to have this fund may be divided, so it seems to me at least, into two different classes: First, the kind of wearing out of the property that goes on continuously each day; secondly, the deterioration in value that comes suddenly, that does not appear in each day or each year, but appears some one future year; and, merely for lack of a better word, I have chosen to call this *sudden* depreciation. It might also be called *occasional* depreciation, using the word occasional in its strictest and narrowest sense. The continuous depreciation that occurs every day is the depreciation through wear and age, the depreciation that comes through the use of the property and the mere effect of the elements. We know, for example, that gas pipes last a very long time, but there comes a day when, even excluding any accidental disturbances, they wear out. Poles and wires, which may be used in the electrical part of the work, wear out much more rapidly; and the machinery, of course, is comparatively shortlived. But the progress of invention is rapid and the growth of our communities, while constant, is irregular in direction; and so it comes about that very little property, excluding perhaps the pipes used by a gas company, wears out. Much more property is superseded, because, in the progress of the art or the growth of the community, newer, better and different apparatus becomes essential. So we have to deal with the elements of depreciation that we call "sudden" due to obsolescence, inadequacy and public requirement. By obsolescence we ordinarily refer to the necessity of superseding a piece of apparatus with something different, not because the old apparatus is worn out but because it is obsolete. Something newer and better has been invented, and if the business is to be kept in a condition corresponding to the progress of the industry—and that is the statutory requirement—the old apparatus must be superseded and the new apparatus must be introduced. A great many features of the gas business have become well fixed, but we cannot say that invention will not change it. No doubt 40 years ago men felt as confident as they do to-day, that their method of making gas was reasonably permanent, and I feel warranted in saying that substantially nothing of the gas house appliances that were in use 40 years ago would be considered as available for one moment to-day. So we must make provision for this danger of obsolescence. Take the second question, which is the matter of inadequacy. We plan a plant for a given size of a community, and use our best judgment on it. We may think the community is going to grow eastward, and we run our large mains that way, and perhaps run small mains to the south and north. Suddenly there comes a change. The community grows to the south, the mains to the east are comparatively little used, the mains to the south are inadequate and must be replaced with larger ones. Or we establish a plant with a given capacity. The community grows, the plant is inadequate, and although perfectly good so far as the operating side is concerned, it must be replaced, because it is inadequate for the size of the community. Now, the situation of a public utility company, as to meeting the demands of the community, is peculiar. It is the legal obligation of the company to meet all the demands of its customers. It must build whether the particular extension be profitable or unprofitable; it must even double its plant if its patrons require the service. Take the beginning of the year 1907 or the year 1906, as an example. If you or I were conducting a manufacturing business, and we suddenly had orders to twice our capacity, we should think that these orders would not continue, so we could not extend our plant to meet the demand, and we should reject the business; but in conducting a public utility you cannot reject the business. You may feel that the growth is only temporary, you may feel that the demand results merely from exceptionally prosperous times, and that you may have a period of 5, 8 or 10 years where a large part of a new installation will be little used, but you must meet the demand none the less. And it is this continual danger of inadequacy, that must be met—inadequacy arising not only from the permanent needs of the community, but also from its comparatively temporary needs, arising from a prosperity restricted to a particular time. Third is the question of public requirement. In a measure, I think this applies less to the gas industry than to the other utilities; but yet it must be met. The company is under the police power of the State, and in many instances that police power is delegated to the local common council, who are apt to act from petty local jealousies or a desire to make political capital in this or that particular ward. So there are both reasonable and unreasonable requirements of the municipality to be met, frequently requiring reconstruction of very substantial parts of a plant. Thus, besides this element of the continual daily loss in value of the plant, because it is growing older and because it is being used and the use through wear is hastening the deterioration through age, comes also the element that some day a new machine is invented and the old machine drops in value 20 per cent. or even more; that some day you wake up and find the community has grown and your plant is inadequate and must be rebuilt; that some day a common council or a legislature tells you to remove pipes from one street or from one depth and insert them at another. And these are the elements of sudden depreciation that come to lower the value of the plant by requiring the old to be thrown out and the new to be installed, and then call for a reserve just as essential as a provision to take care of bad accounts or accidental loss. With this last class, it seems to me, may properly be grouped another class which is really not an element of depreciation in the strict sense, but still is akin to it and properly treated with it, and that is uninsurable casualty. We may know that this or that plant may never have a fire not covered by insurance, and yet if we take 1,000 plants there will be a certain number of them which, dealt with on the basis of average, will have this loss within every decade. This element of an uninsurable casualty exacts a replacement of property, and therefore it also should be included in building up our reconstruction reserve. So then, when we plan a reconstruction reserve, we must deal with the continuous deterioration or depreciation through decay and use, and the sudden depreciation from obsolescence, inadequacy, public requirement and uninsurable casualty. Now, the importance of the distinction in my mind between these two elements of continuous and sudden depreciation has to do with the question of valuation. The method of valuation which has been adopted by the valuation staff, acting for the Railroad and Tax Commission, is to find the reproduction value new, and then to find the value in present condition by

comparison with the reproduction value new. That is, assuming that this tablecloth, for instance cost, say, $2 new, it would be computed that the cloth might have a life of 5 years, and its depreciated value would be based on the computation as to how much should be deducted each year for the fact that at the end of 5 years it would be worth nothing. When we take a comparison of value in present condition with value new, it is quite clear that decay and use—the wearing out of the property through use, and the deterioration of the property through age—necessarily decrease the value continually each year and each day. But how is it as regards the sudden depreciation, the obsolescence, the inadequacy and public requirement? It seems to me, and perhaps I ought to state this somewhat diffidently, because I am giving it as a personal view, that these latter elements do not affect the value of property in its present condition, unless they affect the property now. That is, they ought not to affect the life curve. What I mean by that is this. Assume we have a turbine engine and assume, for the sake of argument, that that turbine engine used normally might last 20 years, and, leaving out questions of interest on the fund, we would say it would deteriorate 5 per cent. a year. Now, that turbine engine is a comparatively new invention. Looking to the future we also know it is almost an impossibility that this class of turbine engine will remain in use 20 years, because long before the 20 years have elapsed, this engine will be too small for the plant, that is, it will be inadequate, or something better will have been invented, so that it will be obsolete; or perhaps the public may require a different apparatus, so that it will have to be superseded for that cause. We guess that in perhaps 5 or 10 years the engine will be superseded. Now, suppose that the engine was worth $1,000 new, and that the engine is 2 years old, how much ought we to lower its value? The time has not come about when there is anything better in the market. The engine is still the best apparatus known. Shall we say that the probable life of that engine is 7 years, and that, therefore, we ought to depreciate it 15 per cent. a year, and at the end of 2 years call it worth only 70 per cent.? Or shall we say that in valuing this apparatus by comparison with a new apparatus, the only difference between the old and the new, measured from any particular point of time, is how much has it worn out, and therefore we should depreciate it merely 10 per cent., that is 5 per cent. per year? I should say 10 per cent., because at the end of the 2 years the old engine is in no more danger of being superseded than the new engine. Future obsolesence is not something that actively affects the value of the old compared to the new. It is a danger that hangs over both. It is like the danger of fire. We know that among 1,000 buildings a certain number will be burned, but the fact that some will be burned in each year does not decrease the value of the old ones as compared with the new. The fact that the normal life of a building would be 100 years, but that it might be destroyed by fire or casualty in a less time, so that the average life, say, is 40 years, does not make the value of the old building, as compared with the new, determinable on a 40-year life basis. So the additional sudden depreciation from obsolesence is something we should provide for by a reserve. It is a danger to guard against like fire or casualty, but it does not go into the question of value when we value by the method of comparing the old and the new. Bear in mind this restriction, that the comparison is between the value of the old and the new, because if an apparatus is obsolete the depreciation in value affects the new as well as the old. Take our same example of a turbine engine, and assume that the turbine engine invented 10 years is already obsolete. The result is that the price of that turbine engine in the market will be very much less than one of the improved pattern. When the valuation staff examines that engine and sees that it is already obsolete, it immediately reduces the value new of that engine for the obsolescence. If you are going to use a life table computed on a 10-year basis, on the ground that, although the normal life of the machine was 20 years, yet it became obsolete and should have been superseded in 10 years, you would be reckoning the depreciation for obsolescence twice. First of all, you would have the new value cut down, because the machine is already obsolete, and, therefore, selling at a reduced price, and you would have also a shortened life table and a larger figure for depreciation, because of the original possibility of obsolescence. So, when you adopt the method of valuation—and that is the common method of valuing property in present condition by comparing it with the reproduction value new, any accrued obsolescence or inadequacy (that is, any that has already become effective) will affect further deduction fair in reaching value in present condition, and therefore is unnecessary and would be unjust; secondly, the danger of future obsolescence has no more effect on the old than it does on the new. The danger that that pitcher on the table before me will become unsuitable, because too small for the use of future users, is just as great whether that pitcher be old or new; and, therefore, if we are valuing it by comparing it in its present condition with a new pitcher, there is no reason why the danger of future obsolescence should affect the present valuation. Therefore I feel that the method of valuation which should be adopted for property in its present condition, should have reference merely to continuous deterioration that comes through age and use, and should not take into consideration the elements of obsolescence, inadequacy and public requirement. But when you come to deal with the matter from the point of view of the companies for their accounting purposes, then you must take all the elements into consideration. If today you wish to put your plant on a sound and safe financial basis, then your accounting system must require you to set aside each year enough money to give you funds in hand to protect you where depreciation or deterioration comes through inventions or growth of the plant. So far as age and use are concerned you can deal with comparatively exact figures. So far as sudden deterioration is concerned, it is a matter of estimate, of guessing the future by the history of the past; but in those cases you ought to do what would be done in a mercantile or manufacturing business in the ordinary business world, which is, allow for a margin of safety. You ought never to run the danger of having your capital impaired. Therefore, there should be set up annually, based on the experience and outlook of each particular plant, a sufficient sum to provide, as the years go by, for the replacement of property that becomes necessary from both the sudden and the continuous depreciation. The question of the treatment of depreciation in the accounts is something over which I will not go into detail, because I feel I have already taken sufficient of your time, but I may say generally that three methods have been proposed. One, and that is commonly used in English associations, is of reducing the capital or the construction account each year, by what is estimated to be the depreciation. Of course, as the depreciation reserve accumulates, it should not only provide for deterioration in value through age and use, but also furnish an insurance fund to cover the necessity of superseding property for obsolescence, inadequacy and public requirement. This method of reducing the capital would require a subdivision of the depreciation account, and besides that would give a continually shifting capital account that would be impracticable in operation. More than that, the terms of our law distinctly contemplate the building up of a reserve. Reconstruction items must be kept separate. The law requires a separate account to be kept of the amount of money that is reserved for this purpose. All expenditures for reconstruction are to be charged to it, and all earnings from the fund reserved must be credited to this account. The law is not explicit, but I think the inference from it is that if the company, following the common practice, invests its reconstruction reserve in extensions, it should charge these extensions to construction account; and in order to build up a reserve, the company should credit the amounts when taken out of earnings to the reconstruction reserve. The final result is the addition to the construction account, and the contra credit to the reconstruction reserve account which balances the books. The earnings would be based on the construction account, because that is the amount of money invested in the business, but before any dividends would be declared an allowance for interest would have to be made to the reconstruction reserve fund, because that fund's earnings must be kept distinct. The theory of the law is that this fund is devoted to reconstruction, and the earnings from it must go to the principal to accumulate. Of course, it is probable that the increase in allowance for the reconstruction reserve, which I think nearly every company will find necessary in order to comply with this law, will cause a temporary disarrangement in the current financial affairs or at least the financial distribution of the company, but in the long run it is going to work for safer and more accurate practice. It is going to tend to maintain the value of the property constantly at the par value of the investment, for it will bring into the practice of the public utilities merely the same principles that are well recognized in current business affairs, and I think eventually we will all feel that it will greatly aid and benefit our undertakings. [Applause.]

Discussing Mr. Mack's Remarks.

The Vice-President—Mr. Mack has covered the ground so thoroughly that I feel sure we can find very little to say in opposition to the ideas he presented to us. Possibly some of you may have something to say in co-operation. We have with us another attorney, who is also the

President of one of the companies in this State, a member of our Association, Mr. Lescher, of Detroit, of the Sheboygan Company.

Mr. Lescher—I know nothing about the gas business, I am simply the Secretary of the Company and record its meetings. I came here to listen and try to learn something about the gas business. Kindly excuse me.

The Vice-President—Will Mr. Duffy give us something on the subject?

Mr. C. N. Duffy, Comptroller of the Milwaukee Electric Railway and Light Company—I do not think anything is to be said after Mr. Mack finished. I think his exposition of the principles is so clear that surely I could add nothing to them.

The Vice-President—Mr. Mack has been talking from the theoretical and accounting standpoint, quite largely. We should be glad to hear something with respect to the operating department, and I will call upon Mr. David Douglas, President of the Eau Claire Gas Light Company.

Mr. Douglas—Mr. Chairman and Gentlemen: I want to say that I never had this depreciation matter so clearly presented as it has been in so short a time by Mr. Mack. There can be no doubt about the accuracy of his statements, nor the clearness with which they have been expressed. The practical matter with which we have to deal he also touched upon, and that is that this means an addition to the cost (I want to confine what I say to the gas business), a very large addition to the cost of gas, in many instances among the smaller works, amounting to from 10 cents per 1,000 to 20 cents per 1,000. In electric light plants the comparative amounts, judged by the kilowatt, will be greater. This becomes a very serious matter from the standpoint of the operator. Very few gas companies, as I understand it, in this State are making any large dividend. How are we to stand this extra expense and earn dividends to which we are honestly entitled unless we raise the rate? As I understand it, this Commission was formed, appointed and has its power and authority given to it, with the public sentiment and belief that companies were making too large profits. Investigation shows they are not making those profits, even with insufficient charges as to cost of operating. What will be the effect on the people when they find that the working of this public utilities act is to raise the price, as a rule, of all public utilities in the State? We men who are operating must be in the front ranks, and we have to fight this matter. You cannot deny for a moment what Mr. Mack has said. The Commission cannot deny for a moment that these extra charges should be added to the cost, and that we are not making profit enough now. And we are going to have possibly a good deal of trouble in our State, because the price of public utilities must be raised. It is a serious matter. It is that thought which has been permeating the mind of every member of this Association. What are we up against? How are we going to live even, and sustain those high charges? Another charge that I think most of us in the smaller companies know is coming under this act, is increased taxation. The Public Service Commission is instructed to make valuations. It is also instructed to report full valuations, as they see them, to the authorities of the district. When that report goes in our assessed valuations in nearly every case will go up. Some will be doubled, others more than doubled. I recall a gas company that has been paying an average of 9 or 10 cents a cubic foot in the past on every 1,000 feet of gas sold; now, if taxes are doubled that company will be paying 20 cents per 1,000 feet on gas for taxes. If you raise the price of gas 25 cents per 1,000, what is going to be the effect upon our gas consumption? We know that lower prices have stimulated consumption, but higher prices must have the contrary effect. It may be that this is one of the solutions of this difficulty of having to build larger plants. Perhaps our business will not be as big as we think it is going to be, because higher prices will be repressive of the industry. I have heard that an Irishman said long ago, with reference to posterity, "Be jabbers, what has posterity ever done for us that we should do anything for posterity?" I want to tell you, the ordinary citizen of Wisconsin, as I know him, wants the cheapest gas he can get, and let posterity take its chances. He does not want to sacrifice himself for posterity. Yet we must look on this matter not simply as operators, but largely we are in the financial field to maintain the value of our securities, and we are opening up a new field of thought. As the result of this public utilities act I think every man here knows more about his business than he did before it was passed, from all these points of view; but we are trusting, and I think not without justification, as our Chairman has said, to the absolute fairness of the Commission to do that which is right; and out of it, I have no doubt, will come benefit to all of our securities and to the business and to the people of the State. Ultimately it is going to be a good thing, but there is no use arguing against the principle of depreciation. It is absolutely in the business and it must be met.

Mr. R. B. Brown, Milwaukee—Mr. President and Gentlemen: I want to emphasize a statement that Mr. Mack made, that may not have gone home to all of you, and that is the absolute difference in the figuring of valuations between that portion of the depreciation which is due to physical decay or continuous depreciation, as Mr. Mack calls it, and that portion due to other causes which cannot be absolutely reckoned with. Now, if a main in this street is adequate to-day for the demands of our consumers, and we know of no reason why the grade of the street should be changed, and so far as its physical decay is concerned it is in good condition, there is no reason why we should make an estimate in the valuation of that main for its future obsolescence or inadequacy, or for the fact that the City Engineer's office and the Common Council may change the grade of the street and require the main to be relaid. We have been required in Milwaukee, and it has become part of the policy of the Company, to relay, overhaul and replace mains on all streets which are paved with permanent pavement. It is not done to save the gas company expense particularly, for in many cases our services and mains are in such known good condition, without examination at all, as to make it possible for us to say that there would be a very small percentage of those services which would have to come up; but we do not take that position, and the city has desired us to overhaul mains and services, so that there shall be no possibility, humanly speaking, of our having to take any of the work up and disturb the pavement during its normal life. Again, on all car track streets, where the question of electrolysis comes in, and where the disturbance of the pavement is always greater for the services crossing to the long side of the street, we have followed the policy largely of putting in a second main system paralleling our original mains on the opposite side of the street, before permanent pavement is laid. Now, all these things, while not a direct depreciation, and which perhaps could not be defined as depreciation, yet practically amount to a lessening of the value of the present property, or an increase in the operating expenses due to these items, either present or future, that Mr. Mack has classed in his second category. But although those things may be known to be coming up in the future, I agree with Mr. Mack that they do not affect the present value of the property at all. In this valuation work, as it is being done by the State Commission, the methods, whatever they may be, of arriving at present value of property, must be more or less arbitrary, and I do not see that we could justly or rightfully add to the uncertainties and to the arbitrariness of many of these methods by forecasting the future. If we could do that with accuracy many items of future obsolescence and inadequacy would never occur. But, as Mr. Mack has already clearly stated, having used our best judgment, then we find out in 5 or 10 years that our hindsight is much better than our foresight was, so we correct our judgment and start out again, and in doing that our accounts are charged with the inadequacy of that particular part of the plant. It may not have been charged to depreciation, but it must be charged to something, and the valuation question should not be complicated by attempting to forecast these features. This is a matter that comes very close home to us, because, with all this valuation work going on in the State, there will many times come up questions as to the value of plant. Occasionally it may be definitely stated that within one or two years a certain piece of apparatus or line or main is going to become obsolescent, and when that can be definitely stated I do not see how the recognition of it can be avoided. But where, as in most cases, it is a matter for the future to determine and a matter that cannot be definitely determined at present, it should not form a part of the valuation or have any influence upon it in determining present value.

A motion was made, seconded and unanimously carried, thanking Mr. Mack, by a rising vote, for his address.

Mr. Mack—I very much appreciate it.

(To be Continued.)

[OFFICIAL.]

ORGANIZATION MEETING, SOUTHERN GAS ASSOCIATION.

Pursuant to a call from Mr. R. C. Congdon, Manager of the Atlanta (Ga.) Gas Light Company, representatives of the various gas companies of the South met, on May 18th, in the Convention Hall of the Piedmont Hotel, Atlanta. The meeting was called to order promptly at 10 A.M., Mr. Congdon acting as Chairman, and J. H. Maxon, to whom much credit for the meeting is due, as Secretary. Following temporary organization, regrets were read from the following gas men who were unable to be present, but who were heartily in favor of such organization.

H. B. Hoyt, Jacksonville, Fla. J. K. Russell, Greensboro, N. C.
G. I. Dewey, Gainesville, Fla. T. D. Miller, New Orleans, La.
I. W. Greenland, Columbus, Miss.

Mr. Jas. Ferrier then proposed organization of a Southern Gas Association, to cover the States of Georgia, North Carolina, South Carolina, Florida, Mississippi, Alabama, Louisiana, Kentucky, Tennessee and West Virginia, and that the Chair appoint a Committee to draw up a constitution and by-laws. The motion carried, and the Chair appointed as the Committee, Messrs. Jas. Ferrier, Chairman; K. L. Simons and D. S. Williams.

On motion, Messrs. R. C. Congdon and J. H. Maxon were added to the Committee. The meeting then adjourned until 2 P.M.

Afternoon Session.

At 2 P.M. the Committee on Constitution and By-Laws not being ready to report, the session was postponed until 4 P.M., the interval being spent in an inspection of the plant under the able direction of the officials of the Atlanta Gas Light Company.

At 4 P.M. the delegates reassembled to hear the report of the Committee on Constitution and By-Laws. After considerable discussion, and some amendments, the report of the Committee was adopted and followed by permanent organization.

It was moved and carried that the Chair appoint a Committee to Nominate Officers for the ensuing year, and the Chair appointed as such Committee: Messrs. A. C. Blinn, Chairman; J. H. Maxon, A.W. Young, M. D. Shindler, James Ferrier and R. M. Redding.

The Committee nominated the following named for office-bearers, who were subsequently declared elected.

President—Mr. T. D. Miller, New Orleans, La.
Vice-President—Mr. R. C. Congdon, Atlanta, Ga.
Secretary-Treasurer—Mr. Jas. Ferrier, Rome, Ga.

Mr. Congdon and Mr. Ferrier thanked the Association for the honors conferred on them, after which it was moved and carried that Mr. Congdon be delegated to notify Mr. Miller of his election.

It was then moved and carried that the Chair appoint a committee to nominate an Executive Committee of 8, of whom 4 are to serve for 1 year and 4 for 2 years; also, that a committee be appointed to recommend a place for next meeting.

The Chair appointed as nominators of an Executive Committee, Messrs. A. D. Whittaker, Chairman: A. W. Young, Jas. Ferrier, J. H. Maxon, M. D. Shindler and R. M. Redding. As Committee on Meeting Place he named Messrs. D. S. Williams, Chairman; Wm. Bailey and A. C. Blinn.

The Committee subsequently recommended for Executive Committee—to serve one year—Messrs. H. W. Frund, D. R. Swing, A. W. Young and A. B. Patterson; to serve two years, Messrs. D. C. Williams, J. H. Maxon, K. L. Simmons and J. H. Haggerty.

The recommendation of the Nominating Committee was received and the gentlemen named were declared elected.

The Committee on Next Meeting Place having recommended New Orleans, a motion was moved and carried to that effect.

The thanks of the Association were tendered the Atlanta Gas Light Company and the Piedmont Hotel for courtesies extended, after which the meeting adjourned.

Among the pleasant features of the meeting were the various trolley rides under guidance of resident members, and the special car and theater party given by the Atlanta Gas Light Company, to the Casino, at Ponce de Leon Park.—R. E. D.

The objects of the Association as expressed in the Constitution are as follows:

First, The promotion and advancement of knowledge scientific and practical in all matters relating to construction and management of gas works, and the manufacture, distribution and consumption of gas.

Second, The establishment and maintenance of a spirit of fraternity among the members of the Association, and ideas on the before mentioned subject matters.

Third. The inducement and extension of friendly relations between the manufacturers of gas and their patrons, based on the mutuality of their interests.

City Gas Lamps and Their Lights as Sewer Ventilating Agents.

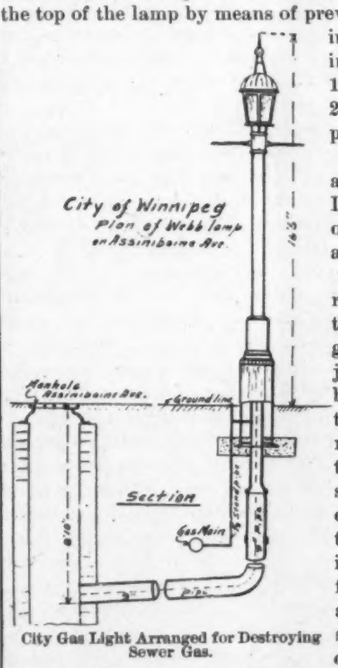
The Canadian "Engineer," in noting that the City of Winnipeg has for quite a while been experimenting with ordinary gas street lamps, as agents for preventing sewer gas from becoming harmful, and in declaring that, while the subject and its applications have been often tried and many, gives the following illustrated description of a plan which, recently tried, seems to possess the element of efficiency.

The engineering staff of Winnipeg has had in charge the recent experiments with ventilation lamps, of the Webb type, and as to efficiency, the report of both the City Engineer and City Bacteriologist appear favorable. City Engineer H. N. Ruttan submitted to the Mayor and Board of control on April 10, 1908, day-to-day reports covering the first 59 days' observations. In these he says:

When the lamps were working most effectively, the velocities in the sewers were only 4.22 and 3.60 feet per minute, or, supposing that the air came both sides of the lamps, as no doubt was the case, half the velocity, or 2.11 and 1.80 feet per minute. In order to make this system of ventilation effective, I should think that lamps would be required, at least one on each 500 feet of sewer.

There appears to be no doubt that the lamp effectively burns and disinfects what air goes through it. This being the case, the gas jet would be as effective if placed on top of the manhole, allowing the products of combustion to escape at street level, and the cost, as compared with the lamp arrangement, would be trifling.

City Bacteriologist Dr. J. H. Leeming in his report to the Civic Health Committee on February 20, 1908, remarked: Plates containing culture-media of blood-serum, agar and gelatine were exposed to the sewer air, both before and after it had passed through the lamp. In the former case the plates were placed in the pipe leading from the manhole to the lamp. In the latter case the air was conveyed from the top of the lamp by means of previously sterilized iron pipe, 12 feet in length. Six plates were exposed in both cases, and for a period of 1½ hours. I calculate that about 2,500 feet of air passed over the plates.



City Gas Light Arranged for Destroying Sewer Gas.

From the plates exposed to the air after passing through the lamp, I could not obtain a single growth of bacteria, thus proving that the air was sterile.

From the plates exposed to the raw sewer air, before passing through the lamp, I obtained a growth of 302 germs. I should judge as many more germs would be swept on before they had time to settle on the plates. No one now disputes that sewer air contains micro-organisms. The unsettled point is whether under all conditions sewage will impart to the air its contained micro-organisms. It has been practically definitely proven that, when there is a formation of bubbles in the sewage, the germs, amongst them, of course, are pathogenic ones. It seems evident to myself that the lamps fulfill admirably the purposes for which they are intended, viz., the prevention of all nuisances arising from sewer manholes.

Metallic Filament Lamps.[1]

The introduction of the metallic filament lamp, with its high efficiency and other characteristics, is a matter of no little significance, regarded from the standpoint either of consumers or suppliers of electricity. There are at present on the market several types of metallic and other high efficiency lamps, but two only as yet have obtained a really firm footing. These are the tantalum lamp and the osram lamp, the former having a filament manufactured from the metal tantalum, and the latter provided with a filament of tungsten. The two lamps have many features in common, although presenting individual peculiarities of an important nature. Both have an efficiency

1. *Engineering.*

of at least from 2 to 3 times that of the carbon lamp, with a useful life of about as long. Both are fragile, each in its own manner and degree, but neither having anything like the general robustness of the familiar carbon lamp. The peculiar weakness of the tantalum lamp has so far been the briefness of its life on alternating current circuits, while the tungsten lamp could only be used with the bulb hanging vertically downwards. The makers of each type, however, now claim to produce lamps in which these defects are overcome, and no doubt further improvements will in due course be effected.

The tantalum lamp, when new, consumes about 1.7 watts per British candle power, and has, according to the makers' statement, a useful life of 800 hours, the useful life being taken as the period elapsing before the light is reduced by 20 per cent. The life of a carbon lamp is about the same, and it has a greater prospect of surviving to the normal end of its days; but its consumption is at least 3½ watts per candle, or more than double that of the tantalum lamp. The tungsten lamp is stated to consume 1.25 watts per British candle power, and to burn about 1,000 hours, with a reduction of efficiency of only 5 per cent. It is undoubtedly a frail lamp, but no other type can show an efficiency so high or sustained.

From independent reports made recently upon osram lamps, supplied by the General Electric Company, Limited, of London, we notice that the watts consumed per mean hemispherical candle power averaged distinctly less than the figure claimed above, and, in fact, did not attain this figure at the end of 1,000 hours, in the case of many of the lamps tested. They were run on a commercial alternating current circuit, with a voltage variation of 3 per cent. on either side of the mean, and 5 lamps out of a dozen lasted out the whole test of 2,000 hours, none consuming then as much as 1.5 watts per candle. In another test of a dozen lamps, by a different authority, the efficiency was fractionally less. Two lamps failed at 700 hours, 1 at 2,700 hours, and the remaining 9 were still running when the test terminated, after 3,350 hours. After 2,700 hours the average consumption per candle power was below 2 watts. The voltage during the test was maintained constant at 112 volts. As regards first cost, the present retail price of a tungsten lamp is about $1, while the tantalum lamp costs 65 cents, and a good carbon lamp can be got for 25 cents.

Were the new lamps strictly comparable with the ordinary carbon lamp, the latter would be at once driven from the market, in spite of its cheapness, for it could not hope to compete with lamps consuming half or a third the amount of current for the same amount of light. But, in addition to having the drawbacks we already noted, the metallic lamps are at a serious practical disadvantage. From the nature of things, their filaments are of high conductivity, and must, therefore, be excessively long and thin to work upon even the lowest of commercial voltages. This not only favors fragility, but renders lamps of low power almost impossible to make. Moreover, the highest terminal pressure that can as yet be used across a single lamp of reasonable power is 130 volts for tungsten and 160 volts for tantalum, so that on most supply circuits in this country it is necessary to run two lamps in series. This involves carefully grading the lamps, for their life is very short under these conditions unless the resistances of both are equal. The General Electric Company have, however, recently put on the market high power osram lamps designed for burning on pressures up to 260 volts, which cover every lighting circuit in the country.

The consumer, then, is generally compelled to substitute two metallic lamps at a point in place of one carbon lamp. This means that he will get probably two or three times the light he previously had, and though it is far cheaper per candle power, the total bill will be pretty much as before. If he wants the extra light, well and good; but it may be unnecessary, and even embarrassing to him, although he has obtained it for nothing. In places where two separate lights may be controlled by one switch, by means of a slight rearrangement of wiring, two carbon lamps in parallel may be replaced by a pair of metal lamps in series, and the full value of their efficiency obtained. Where the system of supply is alternating, the obvious course is to instal a small auto-transformer, and reduce the voltage of the whole house to what is suitable for the particular lamps selected. There will be slight transformer losses, much of which, moreover, will be going on for the whole of the 24 hours, but the current wasted will be very small in comparison with that saved by the new lamps. For tungsten lamps the secondary pressure of the transformer may well be as low as 25 volts, which would allow the use of comparatively robust lamps of very high efficiency, and in units as low as 10 and 16-candle power.

Auto-transformers for use with metallic filament lamps are now being made in thousands. They should be so designed that the iron losses, which are going on all the time, should be kept low, and in practice need not exceed 5 watts on a 300-watt transformer, or 10 watts on a transformer of an output of 750 watts. The insignificance of this will be realized when it is remembered that a 16-candle power carbon lamp consumes something like 60 watts. To avoid the iron losses, such as they are, it is, of course, possible to switch off the transformer when no lamps are needed. In fact, devices have been invented for automatically switching the transformer out with the last lamp, and in again with the first. Such elaborations show a very much exaggerated idea of the losses due to the transformer, which, as a matter of fact, are so small that frequently the current is not sufficient to operate the meter, and, therefore, never gets charged to the consumer at all.

We have so far been considering the question of high efficiency lamps from the consumers' point of view. But it cannot be gainsaid that their general use will seriously affect the business of electricity supply. We may say at once that, arguing from either history, analogy or common sense, the ultimate effect of their introduction must be to benefit the industry, although the immediate future may give rise to anxiety. The consumer only uses metallic lamps because he gets some advantage from so doing. Now his satisfaction may arise from one of two causes: Either he has got the same light as before for less money, or he has got more light for the same money. Whichever of these conditions occurs, the supply company appears to come off badly, because even in the second case a greater proportion of the annual expenditure on lighting will be diverted into the lampmaker's pocket; while if the total expenditure is less than previously, and the lamps cost more, it is evident that the supply company must suffer even more. Of course, the satisfaction of this consumer with the results of the new lamps may reasonably be expected to cause others to take a supply of current, and thus the output of the station may be maintained. This, however, is not necessarily a benefit to the undertaking. Each unit costs just as much to generate whether it is consumed by one man or shared between a dozen, but in the latter case the price charged for it has to carry the charges on mains, meters, etc., required to give the supply to the 11 others. This may easily swamp any profit earned when the supply was taken by a single consumer.

The greatest hope of the central station engineers is that the cheapness of lighting by means of the metal lamps may induce customers to seek advantage rather in the increased quantity of light they may obtain for the same money as before than in the reduction of their current bills. The appetite for artificial light is one that grows by what it feeds on, as is proved by the continuously higher standard of illumination desired, or even considered essential. The lighting considered adequate a quarter of a century ago would not be tolerated to-day for a moment, and there is probably plenty of scope for increased illumination in houses and shops which have up to the present been reasonably satisfied with a comparatively few carbon lamps. In fact, the possibility of better light at equal cost is bound to create a demand for it, and the fact that the new lamps are of high individual power, and have frequently to be duplicated, will tend to foster the demand by accustoming consumers to brilliant lighting.

This is the brighter side of the picture, but the alternative has always to be reckoned with. There is no doubt that the lamp makers will very soon find some way of manufacturing lamps of smaller power that will burn singly on high voltages, and in certain districts and among certain classes of consumers the introduction of such lamps is bound to reduce the demand for current per house. Thus small consumers, who are now barely profitable to the undertaking, will be turned into sources of positive loss, because of the capital charges involved by connecting them to the station. Although we believe such cases will be few and transient, they must be dealt with, or the supply authority must get into financial difficulties. Practically the only remedy is to raise the price of current or adopt some method of charging which will make every consumer bear his fair share of the costs of supply. In either case he has no just cause of complaint, for he cannot expect to be supplied at a loss to the undertaking, and will certainly be getting better value for his money.

Carpenter's Improved Coal Carbonizing Process.

The "Journal of Gas Lighting" reports that the specification of Mr. Charles Carpenter's patent No. 14,371 of 1907 describes his method of distilling or carbonizing coal wherein "a core of coarse pieces is formed within a layer or layers of coal of greater fineness."

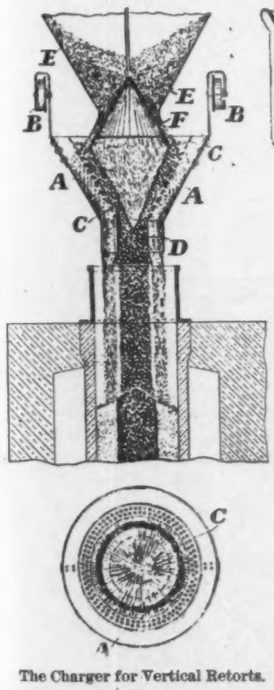
The patentee points out that, in the distillation or carbonization of coal in the manufacture of illuminating gas, it is usual to charge the coal into the retort or other heated chamber without having any regard to the arrangement of the coarse and fine particles or pieces, or, if there has been any attempt at such arrangement, it has consisted in placing the fine particles in the middle and the coarser particles next to the walls of the retort. He has found, however, that better results

from the carbonization may be obtained if the distilling chamber is so charged that the core or middle is formed of the larger or coarser pieces surrounded by a layer of fine particles.

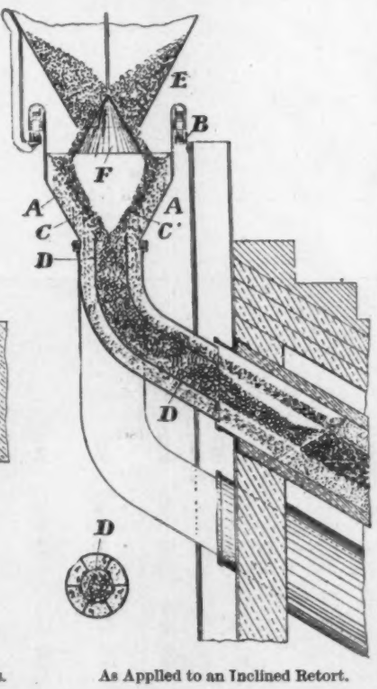
Accordingly his proposal is to so charge the distilling chamber that the coal lies with the largest and coarsest pieces inside and the finest particles outside, or next the chamber walls. The finest portions of the charge are less suitable for the penetration of heat than the larger portions, which do not lie so closely together, and these finer portions are by his method of charging placed close to the walls of the retort, and therefore receive the initial flow of heat from them. The distillation proceeds from the outside, and it takes place last of all in the "core;" and, as the "core" is is made up of all the large portions of coal, their interstices form "convenient channels for allowing the escape of gas to take place with freedom and ease." Similar results may, he says, be obtained "by charging simultaneously with the coal a central stream of coke or coke breeze, the interstices of which also form a convenient channel for drawing off the gas." This latter arrangement is preferred in cases where the coal used is uniformly fine.

The coal may be charged by any suitable means—for instance, a cone shaped screen provided with concentric holes increasing in size towards the center. All the coal is run into this screen, which automatically sorts out the sizes in the way described, with the result that "the retort is charged by different layers of coal increasing in coarseness from the walls towards the center."

The illustrations show examples of apparatus constructed on the



The Charger for Vertical Retorts.



As Applied to an Inclined Retort.

above lines suitable for charging either vertical or inclined retorts.

A is a cone-shaped charging-hopper carried upon wheels running on rails *B* in the usual manner. Within the hopper is fixed a perforated conical screen *C* (so arranged as to leave an annular space between it and the walls of the hopper) terminating at its lower end in a tubular mouth *D*, the perforations preferably increasing in size towards its lower end or mouth *D*. Above the charging apparatus is the coal-hopper *E*, of taper or conical form and having within its lower end or mouth a cone *F*, supported from above. Its position is so regulated as to leave an annular outlet, through which the coal is fed and deflected by the cone *F*, outwardly, on to the walls of the perforated screen.

When the coal is run from the hopper over the cone on to the screen, the smaller coal passes through the perforations and is guided by the hopper *A* into the retort, where it forms a layer of fine material around the walls, while the larger coal passes down inside the screen and through the tubular mouth *D*—thus forming a core of larger or coarser material in the center of the retort.

Referring to the apparatus in the act of charging an inclined retort, it will be seen that the hopper *A* is provided with a tubular extension, suitably curved, for insertion into the mouths of the inclined retorts; and the tubular mouth *D* of the screen *C* is extended within this tube, and is held in position by radial plates. Coal is fed, as before described, from the hopper *E*—the smaller coal passing through the screen *C* and down the tubular chambers, while the larger coal passes down through the tubular mouth *D* and forms a core of coarser material within the retort.

When coke or coke breeze is used for the purpose of producing the "core," a double-charge appliance is provided, consisting of an annular chamber to hold the coal and a central one to hold the coke or coke breeze. A slot or hopper at the bottom of this vessel is opened simultaneously, and the two streams of coal and coke or coke breeze are allowed to flow into the retort.

Vertical Distilling Chambers.

In an article on this subject, contributed by Herr Gustav Horn, of Brunswick, Germany, to the *Journal für Gasbeleuchtung* (translated for the *Gas World*) the author states:

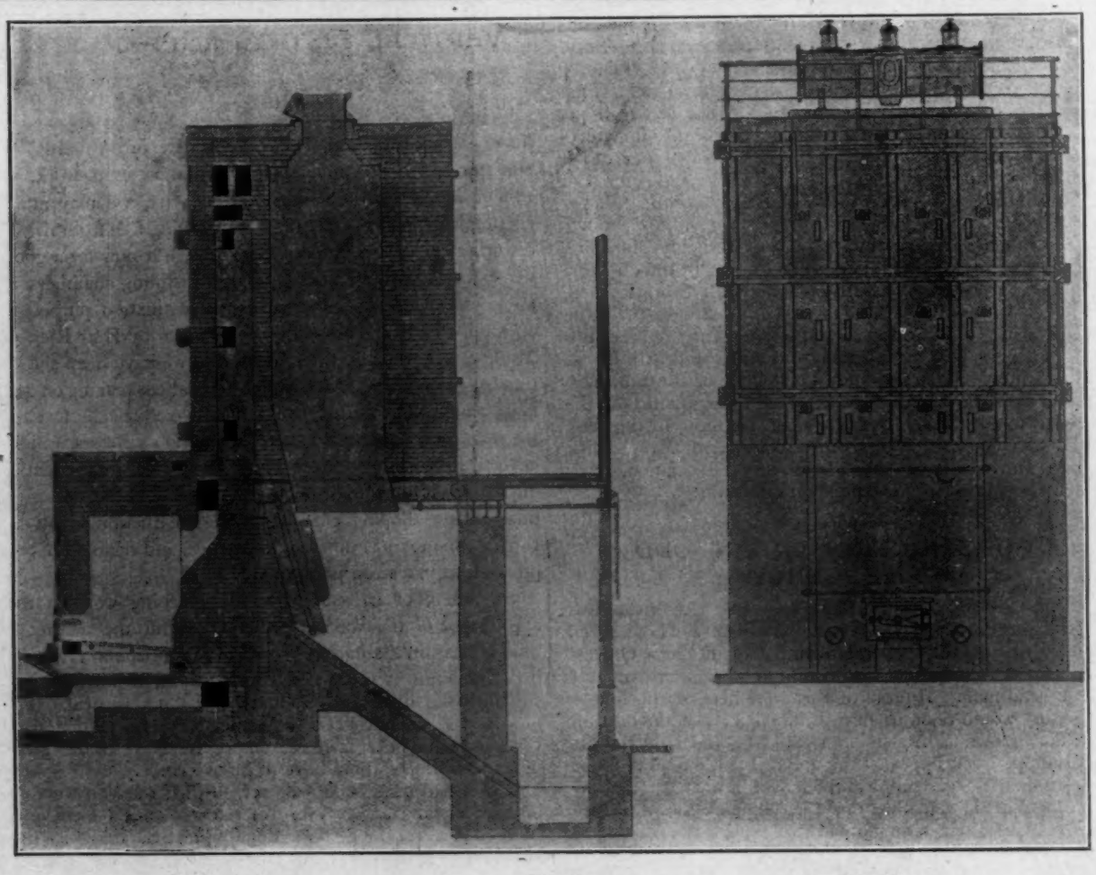
The gas industry has been striving steadily towards the construction of distilling plant for large scale work, in which, along with an increased capacity, one may attain economical results and a mode of working free from risk of disturbance. Dr. Bunte, of Carlsruhe, has for quite a while drawn attention to large distilling chambers as objects worth striving towards for distillation purposes; and it is due to the unwearied pains taken by Herr Ries, of Munich, who took up these ideas, that the gas maker has been shown that plant of this kind is adapted to coal gas making on the large scale. The results in Munich have brought forward many and varied constructions of distilling chambers, which, nevertheless, show scarcely any new idea or essential improvement on the Munich chambers. These constructions all use sloping chambers, so construction involving vertical chambers is different in essence, and deals with the problem from a fresh point of view.

Dr. Bneb, of Dessau, whose far-reaching work in the application of the vertical principle is still the center of interest, has, in his inquiry "Vertical or Horizontal Ovens?" expressed the view that, in course of time, we shall set sloping coke ovens on end and make them vertical. Till now there has not been a practically useful setting with vertical chambers, the reason for which lies in the great difficulties to be overcome.

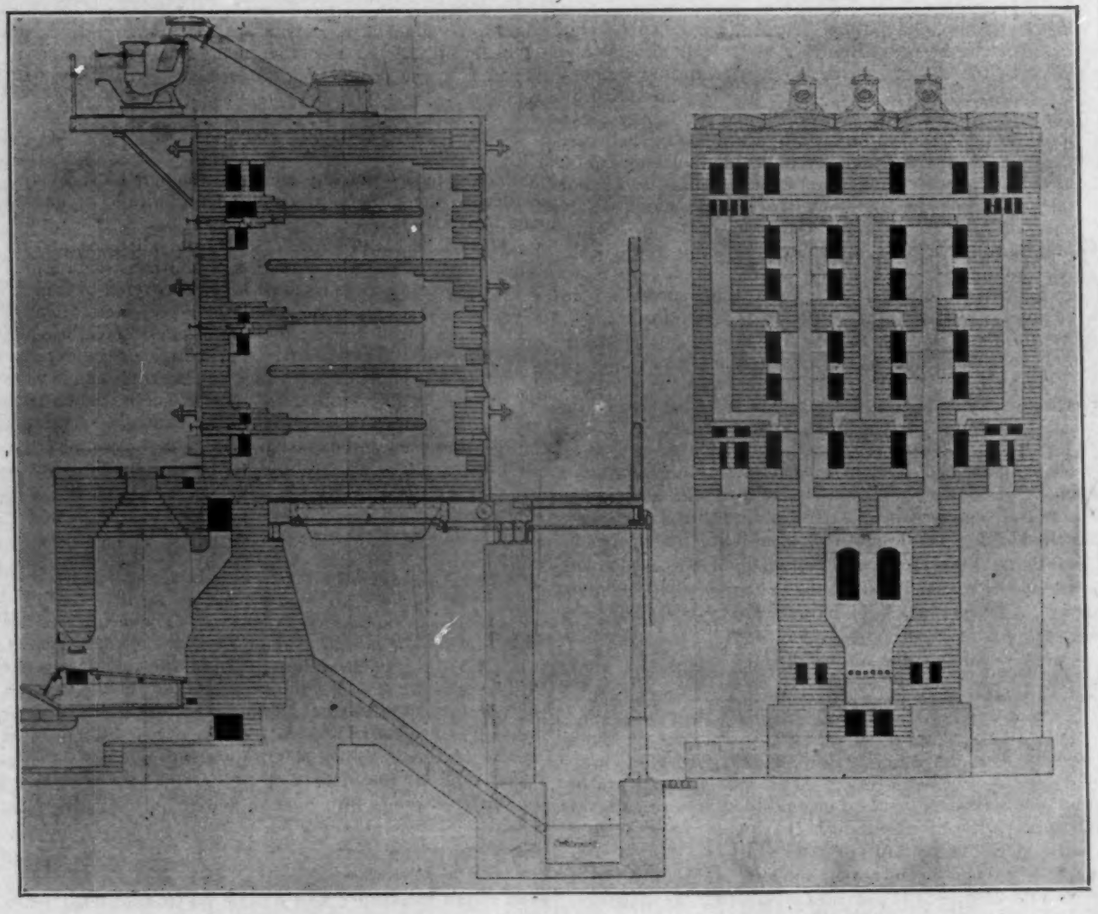
I have also been occupying myself with the construction both of sloping and of vertical retorts; and believe I succeeded in reaching a thoroughly practical design. But this was not gone on with, since, in the course of the work, it became clear that, not retort benches, but large scale settings with vertical chambers, formed the goal which should be striven for. To-day I am in a position to show and to recommend a construction of this latter kind; and I believe it has been so thoroughly worked out from the technical point of view that the element of risk seems to be excluded.

Criteria for Success.—The criteria which any such construction must satisfy in order to meet practical requirements with completeness are the following:

The whole must be accessible from all sides, and the supervision of the entire interior of the construction must be unrestricted; there must be no parts covered over in the interior so that they cannot be overhauled, even when the chamber is in full action; the very smallest crack, leakage or injury, must be indicated by an escape of gas from the chamber, and must be accessible so that faults can at once be stopped at all times. All parts of the construction must at all times and at all stages of distillation, be accessible for painting over and mending. All pipes for producer gas and for secondary air must be arranged within ready reach. There should be as few special blocks as possible. The walls of the chambers may be thin without any danger to their durability, and they must contain as few joints as possible. Vertical joints are to be avoided. The height and breadth of the chambers should be unrestricted, so that it may be possible to specify these to enable one to erect plant either for large or small outputs. The heating of the walls of the chambers should be capable of regulation throughout the entire vertical depth of the column of coal inside; and for this end, the height of the chamber must be divisible into different zones, into each of which only so much heating gas is admitted as is required for the distillation of the corresponding part of the coal. The mechanism for closing the lower door of the chamber must be as simple as possible, and must be capable of standing even rough handling; and it must be disconnected from the brickwork, so that fall and pressure of coal may not act upon the latter.



Section 4—4. Fig. 1. Elevation.



Section 2—2. Fig. 2. Section 3—3.

The firing must be so arranged that the chamber is heated up as promptly as possible.

The Author's Construction.—These criteria, which conjointly render a complete method of working possible, I have endeavored to meet in my construction. Figs. 1 to 4 show a bench in its different

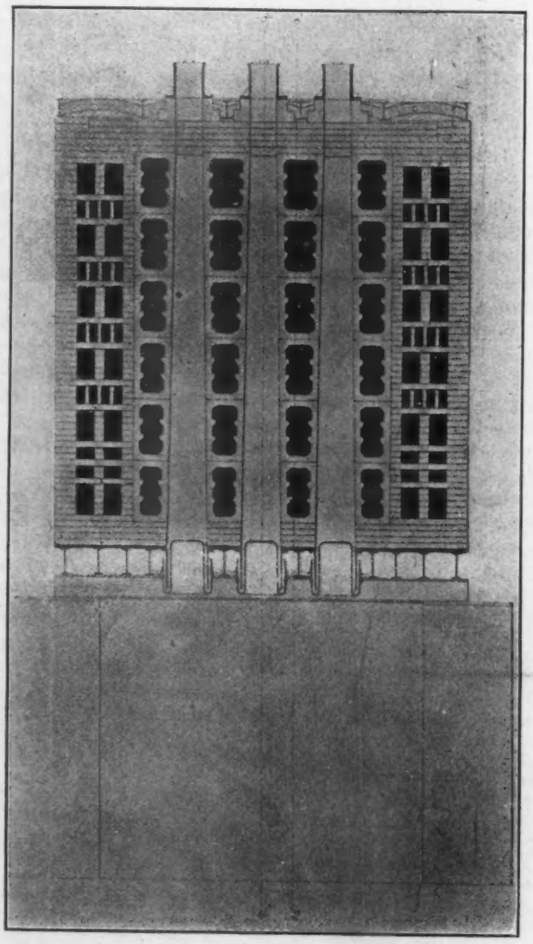


Fig. 3.—Section 1–1.

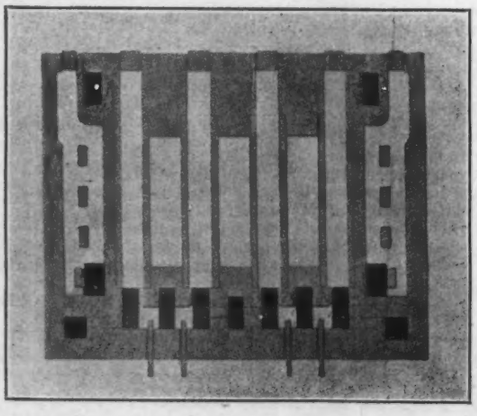


Fig. 4.—Plan.

sections. For smaller works the number of chambers may be reduced to two.

The power of easily increasing or reducing the make, as required, is essential. The period of distillation and the quantity of coal per charge can be determined according to the requirements, by giving the chambers more or less height or breadth. It is easy to regulate the firing from one side, so that the bottom, the top or the middle of the chamber may form the most strongly heated zone. And as the whole wall of the chamber is accessible at all times, leaks may be stopped, etc., at any moment.

As each zone of the chamber receives its own regulated share of the producer gas and secondary air, the gas is completely and, therefore, economically utilized. No gas or air flue is covered in; and it can all be watched during gasmaking, and should any repair prove to be required, the same can be readily and promptly effected. The construction of the walls of the chambers is advantageous in that the heated side carries longitudinal ribbing, which facilitates repairs by means of very small plates luted on.

The lower part of the chamber has a water seal, since this can scarcely be beaten for simple and practical character; it is very conveniently opened or closed, and is not in direct connection with the setting. The fall and the weight of the charge of coal have no effect at all upon the brickwork. The labor required is easy and simple, it requires little supervision, and fresh hands are up to their work within 24 hours.

The introduction of plant with vertical chambers of this design has been resolved upon by the Thuringian Gas Company, Leipzig, which have given me the contract for its new central gasworks, from which it is intended to supply the townships of Slassfurt, Leopoldshall, Hecklingen, Forderstedt, Azendorf and Neundorf.

Economical Lubrication of Large Plants.[1]

[Read by Mr. W. M. Davis at a meeting of the Boston Society of Civil Engineers.]

In lubrication the first consideration is efficiency, then economy. For efficient lubrication the most important thing is lubricant of good quality; next reliable appliances for feeding the oil, so that every drop will go directly to the bearing surfaces. For slow speed engines, ordinary sight feed cups are satisfactory, but for heavy high-speed work a continuous oiling system is most efficient. From an economic standpoint, however, the success of such a system will depend entirely upon the means to catch the oil after it leaves the bearings.

Catching the Excess of Oil from Bearings.—With slow-speed engines and all machinery that uses oil in quantities, every bearing should have substantial sheet-steel pans, arranged, if possible, to drain the oil to some central point from which it can be taken to the filter. If the engine is of the horizontal crank case type, care should be taken to keep the oil as free from water as possible, as water will sometimes travel along the piston rod into the crank case, and, if it is the least bit alkaline, as may be the case where compounds are used in the boilers, the oil and water together will sometimes form an emulsion which is hard to separate and lowers the quality of the oil. The above would not apply, of course, to the vertical steam engine, which uses water in the crank case.

To secure economical lubrication, the first thing is to stop the leaks. Every piece of machinery should be provided with drip pans to catch the oil. In a large plant where several engines are close to one another, the oil pans may be piped to a central tank, whence it can be pumped to the filter. On slow running engines where the pressure is not excessive, and on slow running shafting, a good grade of grease or tallow compound will often give good results, but where compression cups are used the grease should be quite soft so that it will spread freely. If too hard, great pressure will be required to feed it, and it will also tend to increase the friction load.

Where the hub of a flywheel or large gear is so close to the bearing that there is not sufficient space to fasten oil pans under the bearing all excess of oil will be lost. Such bearings can often be lubricated economically by packing a lump of medium hard grease on the journal at each end of the bearing and feeding a little oil in the middle. The grease will prevent the oil from running out too fast, and at the same time help to lubricate.

Cylinder Lubrication.—The proper amount of oil that should be used will have to be determined by experiment. A good quality of oil should be provided, and to get economical results the conditions should be made as favorable as possible—*e. g.*, the steam should be dry; the water in the boilers not too high; an excess of strong alkaline boiler compounds avoided; and, above all, the piston rings should not be set out too tight. Before putting the rings in the piston the edges should be chamfered off slightly with a file, for if they are sharp they will tend to scrape the oil from the surface. From the lubricator the discharge pipe should extend into the center of the steam pipe, so that the oil will drop into the current of steam. Where the engine speed is constant there is little choice between a force feed pump and an ordinary sight-feed lubricator. Either will give efficient and economical service if properly taken care of, but

1. The paper in full is published in the last issue of the "Journal of the Association of Engineering Societies."

where the work is intermittent, the engine stopping and starting, the force feed pump is more economical.

To determine the proper amount of cylinder oil to use, make the conditions as favorable as possible, then gradually reduce the oil feed and note the action of the valves. If they work smoothly all right, but if they commence to groan increase the oil feed slightly. After this the cylinder head should be removed and the surface of the cylinder examined. If it looks oily, and when wiped with a piece of soft paper a stain is left on the paper, it is certain that enough oil is being used.

The Receiving, Handling and Distributing of Lubricants.—If the plant is a large one the oil house should contain storage tanks sufficient to hold a tank car of each kind of oil. By purchasing the oil in cars there will be a saving in the price per gallon and in the labor of handling the oil and empty barrels. In a small plant where only a few barrels of each kind of oil are used a month, tanks holding from 2 to 10 barrels should be provided, so arranged that the oil can flow by gravity from the barrels to the tanks. Care should be taken to see that the barrels drain out clean.

It is customary in a large plant to have a man in charge of the oil house who receives and stores all lubricants, issues and charges them up to the various departments, keeping a record of the amounts given out in a book or on suitable blank forms. To limit the daily amount of lubricants for each department, the chief engineer or master mechanic, when making his daily rounds, can give each engineer an order for his day's supply of oil and grease, and thus know if the amounts required are increasing or decreasing; or an allowance may be made each engine room or department per day or week, which cannot be exceeded except by written order to the oil house storekeeper. At the end of the month the storekeeper totals the amounts of lubricants used and obtains the total cost.

Reduction of Cost.—Nearly all plants spend more than is needed for lubrication, due partly to wasteful methods in use, partly from using unsuitable lubricants, and often to paying prices higher than necessary. The first can be greatly prevented by systematic methods of issuing the lubricants and charging them to the different departments and by installing more economical appliances.

In regard to more suitable lubricants in many plants there is often slow-speed machinery, on which it is not practicable to recover the oil used, in which case a good grade of dark lubricating or black oil will often answer as well as the more expensive oils. A works that was using large quantities of an expensive grade of cylinder oil on its machinery where a heavy machine oil would have answered equally as well, could have effected a saving amounting to over $2,000 a year.

To purchase good lubricants at the lowest prices, it is best to buy on specifications, asking bids and awarding a contract for a year's supply to the lowest reponsible bidder.

Grease.—Greases can often be used with good economy, but they have their limitations. Where the speeds and pressure are low, if they are of the proper consistency and fed to the bearings by suitable compression cups, they often give excellent results. Greases are what is known as "plastic lubricants"; their particles have far less tendency to free movement than is the case with oils. Many greases have as their base a petroleum oil combined with some animal fat, the whole solidified by combining them with a solution of caustic soda, lime water or other alkalies, making a plastic compound that will vary in its lubricating value according to the proportions and the quality of its component parts. While greases have certain advantages as regards cleanliness, ease of application, etc., if used on general mill and factory machinery they will tend to add to the friction load over what it would be if oil were used. To see what this would amount to in the case of the plungers of water works pumping engines, a test was made on a vertical compound pumping engine running under a constant load and at 20 revolutions per minute, having 4 plungers, 2 being 31½ inches in diameter and two 22 inches in diameter, all having a uniform stroke of 64 inches. The plungers were packed with square hemp packing, which had been well soaked in oil, and several times a day were swabbed with oil. Two sets of indicator cards were taken. The first with the lubricated with oil showed the engine to be developing 762.67 horsepower. The plungers were then smeared with soft grease and another set of cards taken, which showed the engine to be developing 835.17 horsepower, making an increase of 72.5 horsepower, or over 10 per cent. In this particular case grease would have been a very expensive lubricant to use. On the other hand, there are places where grease is the only lubricant that can be used. In rolling mill work, owing to the nature of the duty and the construction of the machinery, it is the only lubricant that can be used successfully. On rolls used for rolling rails, structural steel and in merchant mills, the journals or necks are kept flooded with water, and a saponifiable grease must be used, that is, one containing a large per cent. of fatty oils, so that it will adhere to the wet surface. In sheet steel and tin plate mills where it is impracticable to use water, and the journal or neck temperatures often go over 400°, a dense grease compounded with a large per cent. of high flash test petroleum oil must be used.

Awards by Exposition of Safety Devices.

An award of two gold medals and the distribution of 45 diplomas in connection with the Exposition of Safety Devices in New York, was made last month at a luncheon at the Engineers' Club, Mr. Charles Kirchhoff, Chairman of the Committee of Direction of the American Museum of Safety, presiding.

Dr. W. H. Tolman, Director of the Museum of Safety, announced that there had been 112 entries for the Exposition held at its rooms during the last few weeks. Many of them were new and held at once the interested attention of the engineers and other technical men. Through the co-operation of the *Scientific American*, a gold medal was offered for the most meritorious invention at the Exposition in the field of transportation. The members of this jury are: Prof. F. R. Hutton, Cornelius Vanderbilt, John Hays Hammond, H. H. Westinghouse, George Gilmour, Samuel Sheldon and Stuyvesant Fish, who reported as follows:

"The Jury of Award to select from the safety devices exhibited at the Exposition of 1908 the most meritorious invention in the field of transportation among those brought together, present the following report as their recommendation and award:

"After extended conference and consideration upon the rules which should govern the procedure of the jury, it was agreed:

"1. That the term 'field of transportation' covered by the deed of gift of the *Scientific American* medal included the devices and apparatus having to do with the safety of transfer of the public and of the operatives in control on the railways, by elevators and on the water.

"2. That by the terms of another provision for a Jury of Award for devices and meritorious invention in the field of transportation by motor vehicle, this section of transportation was specifically excluded.

"3. That devices usable in transportation in which safety was a secondary although necessary element, and hence subordinated to a primary purpose other than safety, were not to be considered in competition. Safety must be the primary and perhaps the only object to be sought by the device.

"4. That devices exhibited which were meritorious inventions were not necessarily entitled to award if there existed other devices not exhibited seeking the same object and having equal or greater claims for consideration.

"Within these limitations the jury decided that any devices to claim consideration must possess the following elements or attributes; and that device exhibiting these qualities to the highest degree should receive the award, viz.:

"1. Applicability, wide or narrow. Does the device procure safety for a large number of persons, or in a great variety of conditions? 2. Practicability. It must be capable of being used successfully. It must not be too cumbrous or intricate to apply or to operate. 3. Simplicity. It must not be so complicated that experts are required to handle it or to keep it in repair and operation. 4. Reliability. It must not be liable to derangement, causing failure to work in emergency. 5. Durability. It must not be so delicate or require such fine adjustment that when installed it will not last in service. 6. Commercial availability. It must not be too expensive in first cost to install, or in operation to maintain."

In applying the above rules and requirements to the exhibits shown in the Exposition of 1908 the jury awarded the medal tendered by the *Scientific American* to the Rich marine fire indicating and extinguishing system, and made honorable mention of the Whelin Quadrant Davit Company and the Simmen Automatic Railway Signal Company.

The gold medal offered by Mr. Francis H. Richards, the inventor, for the best device in the field of motor vehicles was awarded to the Non-Explosive Safety Naphtha Container Company, with honorable mention to the Rutherford Wheel Company. The jurors for this department were, Dr. S. S. Wheeler, Mr. Caspar Whitney and Mr. A. G. Batchelder. The winning device can be applied to a gasoline or naphtha can, making the explosion of its contents impossible.

Among other awards yet to be made is that of a gold medal offered by the Travelers' Insurance Company for the best invention in the Departments of Mines and Mining.

Bureau of Information, The American Gas Institute.

BUREAU OF INFORMATION,
THE AMERICAN GAS INSTITUTE,
HEADQUARTERS, 716 LOCUST STREET, ST. LOUIS, MO.
W. A. BAEHR, Chairman.

Question No. XVI.—"At what cost can hydrogen be produced? Has hydrogen in itself any illuminating value? Can it be compressed without losing its calorific value? Is it as explosive as acetylene?"

The Bureau of Information has received one answer at large to Question No. 16, which goes into the subject so satisfactorily that the Bureau accepts that answer as its final answer. In addition to the information contained in Mr. Tutwiler's answer anyone interested is referred to the *Journal of Gas Lighting*, April 7th, 1908, in which number there is a description of the process for the recovery of pure hydrogen from water gas.

ANSWERS AT LARGE.

By Mr. C. C. Tutwiler, Philadelphia, Pa.—In a paper read by Dr. O. Schmidt, before a meeting of the German Electrochemical Society, Zurich (see *Journal of Gas Lighting*, London, January 1st and October 15th, 1901), it is stated that, by the electrical decomposition of water, using soda as the electrolyte 168 liters of hydrogen and 84 liters of oxygen can be produced per kilowatt-hour. It was proposed to compress the gas to 150 atmospheres, and use it in Welsbach mantles for isolated lighting. The cost of power for compression was said to be about 5 per cent. of the cost of power for production; therefore, 1,000 cubic feet of hydrogen would be produced and compressed at 150 atmospheres at an expenditure of 177 kilowatt hours.

A full description of a second method of manufacturing electrolytic hydrogen, known as the Garuti process, will be found in the "Scientific American Supplement," June 27, 1903. Working figures on this process show results closely corresponding to those obtained by the Schmidt process, a yield of 166 liters of hydrogen and 83 liters of oxygen being claimed per kilowatt-hour, or 170.5 kilowatt hours per 1,000 cubic feet of hydrogen. The cost of maintenance is said to be very small, since the anodes have to be renewed and these last 3 years.

BY ACTION OF ACIDS ON METALS.

(a) From zinc and sulphuric acid: The cost of producing hydrogen by acting on zinc with sulphuric acid for raw material alone will be about $13 per 1,000 feet of gas, as follows: According to the reaction

$$Zn + H_2SO_4 = ZnSO_4 + H_2.$$
$$65.5 + 98 = 161.5 + 2.$$

it requires 65.5 pounds of zinc and 98 pounds sulphuric acid to produce 2 pounds of hydrogen, or 377.2 cubic feet (188.6 cubic feet hydrogen weigh 1 pound); therefore, to produce 1,000 cubic feet of hydrogen, 173.6 pounds of zinc and 259 pounds of sulphuric acid must theoretically be employed. Since the zinc is only 98 per cent. pure, and the acid 93 per cent., the actual amount of commercial material necessary for the theoretical production of 1,000 cubic feet of hydrogen will be 177.1 pounds of zinc and 278 pounds of acid, and since it will not be possible in practice to obtain the theoretical yield, 10 per cent. should be added to cover such losses. The zinc costs about 5½ cents per pound, while the sulphuric acid will cost about 1 cent per pound, or 1,000 cubic feet of hydrogen when made by this method will cost for

Zinc, 194.8 pounds, at 5½ cents.....	$10.23
Sulphuric acid, 305.8 pounds, at 1 cent....	3.05
	$13.28

To this must be added interest on the investment, depreciation and labor charges. The zinc sulphate formed as a by-product will constitute a credit against these charges. In the production of 1,000 cubic feet of hydrogen about 823 pounds of crystallized sulphate will be produced.

(b) *From iron and sulphuric acid.*—In the production of hydrogen, using iron instead of zinc, the cost will be much less, but the process does not produce as pure hydrogen, and for other reasons, too, the employment of zinc is to be recommended, *when cheapness of production is not of first importance.* The reaction with iron is as follows:

$$Fe + H_2SO_4 = FeSO_4 + H_2.$$
$$56 + 98 = 152 + 2.$$

To produce 1,000 cubic feet of hydrogen the theoretical amount of acid will be the same as when using zinc, while the iron required will be 149 pounds. In connection with the manufacture of hydrogen for inflating balloons, it is stated, in "Payen's Industrial Chemistry," that, in order to produce 500 cubic feet of hydrogen, 150 kilograms of scrap iron, as free as possible from oxide, was employed, and 2,500 kilograms of sulphuric acid diluted with 15,000 kilograms of water; 7,500 kilograms of iron sulphate was obtained as a by-product, or to produce 1,000 cubic feet.

Raw Material.

Scrap iron.. .	187.2 pounds,	or 25.6 per cent. above theoretical.
Sulphuric acid	312.0 "	12. " " "
Water.....	1,872 "	

With iron at ¼ cent per pound and acid at 1 cent:

187.2 pounds iron at ¼ cent =	$ .93
312.0 pounds acid at 1 cent =	3.12
	$4.05

The iron sulphate produced per 1,000 as a by-product will amount to 936 pounds.

(c) From water gas: A description of method of manufacturing hydrogen from blue water gas is given in the *Journal für Gasbeleuchtung*, January 18th, 1908. The author states that by passing water gas over calcium carbide in heated retorts, the calcium carbide not only removes the carbonic oxide, carbonic acid and oxygen, but also the nitrogen, resulting in the production of pure hydrogen. To reduce the use of carbide to a minimum, CO and CO_2 were removed previously from the water gas by the use of other absorbents. By washing the gas with cuprous chloride (Cu_2Cl_2) a gas containing 80 per cent. of hydrogen was obtained. By combining the method with lime washers for the removal of CO_2, there resulted a gas containing 89 per cent. of hydrogen from which the residue of CO, O_2, and nitrogen was removed by passing the gas in a retort overheated calcium carbide. The hydrogen obtained was from 99 to 99.6 per cent. pure.

The foregoing method of procedure, however, proved very troublesome and uneconomical. The author, therefore, turned his attention to devising a more satisfactory method. He found that the CO could be removed mechanically by liquefying the water gas in a Linde air liquefying apparatus. The power necessary for the liquefying of the CO is said to be so low that it is less than that obtained by burning the CO in a gas engine. The author has constructed an experimental plant at Hollreigelsgreuth near Munich with a special water gas producer for an hourly production of 10 cubic meters (= 353.15 cubic feet), and which will soon by put in operation. The cost of production of hydrogen by this method is not given.

Has Hydrogen in itself any Illuminating Value?—Not in the sense in which the term is generally employed. It burns in a flat flame burner with a non-luminous flame, but in a Welsbach mantle it will develop according to Dr. Schmidt about 12½-candle power per foot.

Can Hydrogen be Compressed without Losing Its Calorific Value?—Yes.

Is It as Explosive as Acetylene?—According to Dr. P. Eitner, of Carlsruhe (see *Journal of Gas Lighting*, March 18, 1902), the highest and lowest percentages of hydrogen with which explosion was obtained were 9½ and 66.3, hence the explosive limits with air were between 9.45 per cent. and 56.4 per cent. of hydrogen in the mixture. Butterfield states that, with mixtures of air and acetylene when the proportion of acetylene is more than 4 or 5 per cent. and less than 80 per cent., the mixture exploded when ignited.

From the foregoing figures it appears that the explosive limits of acetylene are somewhat wider than for hydrogen. Acetylene, however, ignites at a temperature of 480° C., which is much lower than the temperature of ignition of other combustible gases, and since it is an endothermic compound it is liable to explosive decomposition. For this reason it is unsafe to store undiluted acetylene under pressure of more than a few inches of water except under exceptional circumstances. According to Butterfield the storage of considerable quantities of undiluted acetylene at pressures of 2 atmospheres and upwards is attended *with great risk*, as under such conditions it will explode if fired by any means, though it contains no traces of air or oxygen.

The foregoing does not refer to the storage of acetylene over acetone. It is stated that at a pressure not exceeding 6 or 8 atmospheres, where there is no exposure to high temperatures, solutions of acetylene in acetone are much safer than acetylene gas at the same pressure or liquefied acetylene.

Question No. XVIII.—"Is the flame temperature of a Bunsen flame greater than that of a luminous flame, provided the consumption and pressure are the same, and gas is burned under ordinary atmospheric conditions? Is a gas radiator equipped with a Bunsen burner more efficient than one equipped with a luminous burner?"

ANSWER BY THE BUREAU OF INFORMATION.

The flame temperature attained by any combustible gas is affected not only by the amount of heat generated by the unit quantity of the kind of gas, but by the amount of oxygen allowed to complete combustion, and by the method of burning, and as to what amount of diluent gases, nitrogen, which it is necessary to heat up in the process of combustion.

The theoretical flame temperature of a gas is independent of the character of burner, and is the highest temperature that can be obtained when no heat is lost in any way, and all of the heat developed is used to heat the products of combustion, and the amount of air supplied to the gas must be exactly that required for complete combustion and no more. This theoretical flame temperature is never attained in practice, because of the cooling effect of the surrounding air and the difficulty of so regulating the air supply as to give perfect combustion without an excess of air.

To obtain perfect combustion with an ordinary open flame burner, it is necessary that the gas should be spread out in a thin sheet, the combustion taking place on the surface and consequently over a considerable area. In the Bunsen burner, on the other hand, the larger part of the air needed for combustion is mixed with the gas itself, so that the resulting flame is smaller and the heat generated in a smaller space. Consequently the Bunsen flame loses less by radiation and the heat generated can be concentrated on a smaller spot, giving the apparent effect of a higher temperature although the total heat is the same and the hottest point in the Bunsen flame no hotter than the hottest point in the open flame.

Such authorities as Rensen, p. 400, "Inorganic Chemistry;" Poole, p. 168, "Calorific Value of Fuels;" Lewes, Waggoner, Warburg, pp. 354-7, "O'Connor's Handbook;" all seem to agree that the maximum temperature in burning any kind of gas is found near the top of the luminous zone in the luminous flame. The average temperature of the Bunsen flame is naturally higher than the temperature of a luminous flame of the same gas, because the combustion is more intensive, being completed in a smaller volume and offering a smaller surface for dissipation of the heat which raises the temperature of the products of combustion. A blowpipe with air is only a case of greater concentration. The difficulty of obtaining the actual temperature is very great, and is sufficient excuse for the varying results found by different experimenters.

Ferry, in the "Comptus Rendus," 1903, tested a Bunsen burner: Air on, as 1,871° C.; air half-on, 1,812° C.; air off, 1,712° C.

In each flame these were the highest temperatures found. The temperature thus given with the air off, cannot be taken as the temperature which would be obtained with a properly designed luminous burner, and consequently the foregoing figures do not contradict the the statement made before, that the maximum temperature is found near the top of the luminous zone in the luminous flame.

As to the second half of the question, the total amount of heat developed by the complete combustion of gas of the same character will be exactly the same, whether burned in the luminous type of burner or in the Bunsen burner, if complete combustion is effected in both cases. In the case of the luminous burner this is more certain to be the case and, assuming a properly designed burner for both types of heaters, there would be no difference in the efficiency. The question inquires concerning the relative efficiencies of Bunsen and luminous flame radiators. Accepting this question literally, and that inquiry is made as to the efficiency of the two forms in giving out *radiant* heat, the following may be of some little interest:

As before stated, with equally perfect combustion of gas by the two flames, the heat developed by the consumption of a given amount of a given gas in the two burners will be exactly the same; the Bunsen flame is a little more liable to incomplete combustion and consequent waste of unburned gas, but the burners ordinarily provided in appliances are so good that, with proper operation and keeping the flame from too intimate contact with cold surfaces, it will be just as efficient as the luminous flame. This equal amount of heat developed by the two burners passes away from the flame in two ways; part of it is radiated, and the remainder passes off as sensible heat of the products of combustion, or sensible heat of air, which is warmed by contact with the stove. It is often desirable to secure as great an amount of radiant heat as possible, since this is thrown off in all directions in the lower part of the room, whereas hot products of combustion or air heated by contact with the stove tend to rise and remain near the ceiling of a room. Now, the luminous flame is a much better heat radiator than the Bunsen, and consequently if radiant heat were sent out only by the flames the luminous flame would be the more efficient. To make the Bunsen flame heater thus efficient with respect to radiation, however, its products of combustion are made to pass over asbestos or other solid surfaces, which are thereby heated and give out radiant heat; if a Bunsen flame heater thus equipped discharges its products of combustion at the same temperature from the heater as does a luminous flame heater, and if the air heated by external contact with the heater is the same in quantity and temperature, then the Bunsen flame heater must consequently send out just as much *radiant* heat as does the luminous flame heater.

Items of Interest
FROM VARIOUS LOCALITIES.

THE Fort Smith (Ark.) Light and Traction Company has arranged for an extension of several miles to its distributing system. No pipe smaller than 4 inches in diameter will be laid.

MR. W. H. HARRISON, JR., of Biloxa, Miss., has obtained from the authorities of Anderson, S. C., a 30-year franchise for the operation of a gas works in that settlement. He informs us that, acting in conjunction with Chicago capitalists, the plant will be constructed this summer. Under the agreement with the authorities it is stipulated that the initial selling rate will not exceed $1.60 gross, or $1.50 net; that construction work will be commenced within 6 months and that gas will be laid on in 12 months.

MR. J. P. TARR and associates have obtained a franchise for the construction and operation of a gas works at Hillsboro, Tex. The franchise is to run for 20 years.

THE current dividend of 1 per cent. on the capital stock of the Wilkes-Barre (Pa.) Gas and Electric Company is payable the 1st prox.

THE death of Mr. Sedgwick Dean, of Ann Arbor, Mich., who was the principal shareholder in the Owosso (Mich.) Gas Company, necessitated its reorganization. The result of the counsellings is shown in the list of officers chosen: President, O. S. Williams; Secretary, Miss Elizabeth Dean; Treasurer, J. C. Lear; General Manager, Superintendent and Purchasing Agent, A. T. Lear.

MR. W. H. COOPER, Superintendent of the Chuctanunda Gas Light Company, of New Amsterdam, N. Y., accompanied by Francis Morris II., sailed for Europe, per steamship Cedric, the 21st ult., for a 2 months' tour of England and the Continent. Mr. George West will have charge of the works during the absence of Mr. Cooper.

THE New Haven (Conn.) Gas Company has purchased 22 acres of land in the town of Milford, which place is about midway of Bridgeport and New Haven. The pipe continuation of the New Haven Company's service between Woodmont and Milford will be completed by June 30th.

MR. FRANK D. MOSES is well along towards completing his purifier construction for the plant of the New York and Richmond Gas Company, Staten Island, N. Y. These boxes are two in number, and of the dimension of 30 by 36 feet, and 15 feet in depth.

THE United Gas Improvement Company is constructing a valve house at the corner of G and Atlantic streets, Philadelphia, which will be when completed the second largest in this country. If we mistake not the valve house on the East side of this city that is operated by the Consolidated Gas Company is the largest one in America.

A CORRESPONDENT in Neenah, Wis., writing under date of the 25th ult., says: "I am sorry to write you that Mr. C. M. Higgins, who is well known to every resident of Neenah and Menasha, from his connection with the gas supply of the named places, has removed to Centralia, Ills., where he has purchased control in the gas and electric lighting properties of Central City and Centralia. For over a year he has been trying to accomplish this purpose. The twin cities are practically one and are well located in the heart of the Illinois coal belt, and for miles around the country is noted for the producing capacity of its fruit trees. These places have a population of 15,000. While we regret that he goes away from us, we rejoice in the knowledge that he goes on to wider and more important fields of usefulness.—V. W."

THE Pulaski Gas Light Company, of Little Rock, Ark., has filed a certificate announcing an increase in its capital stock from $316,500 to $663,350.

THE proprietors of the Worcester (Mass.) Gas Light Company have petitioned the Gas and Electric Light Commissioners for the right to issue additional capital stock. The hearing was set for the 8th inst.

THE Lowell (Mass.) Gas Light Company concluded the last week in May a very successful series of demonstrations on the use of gas for cooking, which were conducted by Miss Webber. The lectures, which were given in the handsome appliance headquarters on John street, were remarkably well attended.

THE proprietors of the Decatur (Ala.) Electric Light, Power and Fuel Company are considering the advisability of extending the gas mains to and through the outlying settlement of West Decatur.

THE case of the *State Journal*, of Madison, Wis., against the Madison Gas and Electric Company has been put over to the 22d inst. The burden of the plaint is that the newspaper men want lower rates and better service. Meanwhile it seems pertinent to remark that the prevailing thought over the matter throughout Wisconsin's gas making circles was that Madison was being pretty well served in both respects complained of.

"T. M. S.," writing from Adrian, Mich., under date of the 26th ult., forwards the following: "The fourth annual banquet of the Adrian Gas Company, given for the better companionship of its 30 employees, was given at the appointed time in the parlors of the Y. M. C. A., and it was a very enjoyable occasion. The service began at 6:30 P.M., and when the tables were cleared Mr. J. McPhail, of the Adrian Company assumed the post of toastmaster, and acquitted himself admirably. The speakers and their subjects were: 'Loyalty,' E. F. Lloyd; 'Organization,' R. Shacklette; 'The Public Service Company and the Press,' by S. H. Perry; 'Execution,' by W. J. Barrett; and 'Recollections, for the Benefit of Youngsters,' by T. A. James. Mr. Lloyd's remarks were particularly cogent and up-to-date.

MESSRS. GRIFFITHS & Mitchell, attorneys, Pittsburgh, Pa., have applied to the Court of Common Pleas, No. 1, Allegheny County, Pa., for a decree dissolving as a going corporation the Pittsburgh Gas Stove and Manufacturing Company. The first hearing was set for last Saturday.

SUPERINTENDENT W. P. KNOWLES, of the Richmond (Va.) municipal gas works, reports that the new water gas set is working satisfactorily, and that all of the reconstruction work there under way—the items in this respect were heretofore published in the JOURNAL—will be completed by December 1st.

CONTRACTS for the construction of the gas plant for Missoula, Mont., have been awarded and it is thought that everything will be in readiness to supply the prospective consumers on or before September 15th.

MR. GEORGE WILLIAMS, General Inspecting Engineer for the Doherty syndicate lighting properties, was in Knoxville, Tenn., the other day and it is quite likely that the main system of the Knoxville Gas Company will come in for a stretch of extending this summer.

A FEATURE of the kitchen equipment of the Richelieu Cafe, on Congress avenue, between Main and Fannin streets, Houston, Tex., which was opened to the public the morning of the 1st inst., is its gas cooking apparatus. These comprise 4 large gas ranges, 7 gas broilers, and a score of griddles. The chef is Mr. L. Buerger, whose ability in his art has often been availed of by the Houston Gas Company, when the latter was at divers times holding demonstration lessons on cooking by gas for the better culinary education of the housekeepers of Houston.

ONE of the "urgent matters" recommended to the Legislature by Governor Hughes as further excuse for reconvening that body in extra session is connected with the appeal by the State from the decision of the lower court sustaining the contention of the Consolidated Gas Company that the 80-cent gas rate law was unconstitutional. It seems that the Governor discovered that no special appropriation for the expense of continuing the litigation had been made, wherefore in his proroguing message he asserts: "It appears that no appropriation is available to cover the payment and deposit required in order to avoid a dismissal of the appeal, which has been advanced and set for argument next Fall, and immediate provision should be made for this purpose." This looks like sending live money after lost money; but, then, it keeps the lawyers busy.

MR. E. T. FERRIS, writing from Omaha, Neb., under date of June 2d, says: "I have failed to find anything in last week's JOURNAL relating to the action of the first court in the instance of the suit brought by one Thomas Blackburn to enjoin the carrying out of the contract for the public lighting of Omaha for a certain term. This ordinance was passed by the Common Council under rather extraordinary circumstances, in that the contract was ratified despite an injunction issued by local judge Sutton in restraint of it, and that the Council in its session was guarded by a number of policemen. Judge Kennedy, before whom the injunction proceedings were argued, finds that was no irregularity in Parliamentary procedure, that the contract ordinance was properly before the Council for passage, that it was not shown that the presence of policemen in the Council Chamber had influenced the Council to pass the ordinance, or that there was any fraud upon the city which should render the contract invalid. He could not, he declared, take into account in the present suit the question whether this contract was the best one which could have been made, or whether the terms of the contract had since been lived up to by the Company. The injunction was accordingly dismissed."

"OBSERVER" sends the following, which appeared originally in the Boston, Mass., *Transcript*, dated the 1st inst.: "The Board of Gas and Electric Light Commissioners to-day recommended to the Edison Electric Illuminating Company: 'That, on and after July 1, 1908, it offers to sell electricity for any use at a uniform price not to exceed 12 cents per kilowatt hour, and that, if a customer elects to be served under the present schedules, whenever the average price per kilowatt hour charged to him for any year thereunder exceeds said uniform price his account shall be so adjusted that he shall not pay more than said uniform price.' The Board also recommends that, on or before the first day of October, 1909, said uniform price shall be further reduced by account as may be approved by the Board, unless meantime the Company shall show the Board good cause why such further reduction should not be made, or this question is reopened by complaint for reduction of price as provided by law. After reviewing the evidence presented to it, setting forth in detail the present system of rates enforced by the Company, the opinion recites: 'The Board is convinced that the present system of rates has operated to select as customers those whom the Company deemed desirable, and has tended to discourage small users of electricity from becoming customers. To the extent to which this is true the Company is disregarding its plain duty. Furthermore, in the opinion of the Board, the value of the small user to the Company may have been overestimated.' Concerning the giving of special rates to certain customers the Board states: 'There can be no possible justification for the Company to depart from its published schedule of prices, or to give any advantage, directly or indirectly, to one customer not offered to others enjoying or seeking the Company's services under like conditions. The Board recommends that the practice be discontinued as promptly as may be consistent with the fulfilment of existing contracts which cannot legally be canceled. The municipal schedules, so far as these relate to the lighting of municipal buildings, contain special discounts already described, which are not offered to private consumers. The Board knows of no logical or consistent basis upon which such special discounts can be defended, and recommends their discontinuance.' The Board makes no recommendations relative to street lighting rates, as they were not under discussion at its hearings, probably because of the fact that the principal municipality served by the Company, the City of Boston was at the same time engaged independently of the Board in an arbitration of the street lighting prices."

AT the annual meeting of the Bangor (Me.) Gas Light Company the officers elected were: Directors, M. W. Stroud, V. K. Gould, John Lowry. F. A. Wilson and Walter Godley; President, M. W. Stroud; Secretary and Treasurer, Walter Godley; Superintendent, W. K. Gould.

THE reorganization meeting of the Consumers Gas Company, of Atlantic City, N. J., is set for the 19th inst. The annual meeting of the shareholders is also scheduled for the same day.

RUMOR has it that negotiations looking to an agreement between (if not a purchase-and-sale) the Utah Gas and Coke Company, of Salt Lake City, and the Utah Railway and Light Company, of the same place, as to rates and the like is in an advanced stage. The usual formula and practice.

THE Supreme Court, of Michigan, has handed down a decision which affirms the right of the Detroit City Gas Company to charge differential rates for the gas sold by it, providing the first grading in all instances remains the same. The decision also covers the point that gas used in engines or for power purposes generally may be charged for at a rate differing from the charge made for gas for lighting or cooking purposes. The decision was rendered in the action originally instituted by H. J. Boerth, who tried to secure an order requiring the Company to supply gas to his restaurant for cooking use at the rate charged a neighbor for gas with which he operated a gas engine. The rate for gas for power was 60 cents per 1,000; for cooking and lighting was 80 cents.

THE Directors of the Maryland Coal Company have declared a semi-annunl dividend of 2½ per cent. on the preferred stock, payable the 30th inst. Last year at this time the Company declared a regular dividend of 2½ per cent. and an extra dividend of 1½ per cent.

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand anytime of Wednesday.

MONDAY, JUNE 8, 1908.

The Market for Gas Securities.

Consolidated, on large trading, sold off a trifle last week, but the decline was not in ratio with the losses reported in shares of the standard trading type. Consolidated at noon to-day (Friday) is 123 to 123¼. Brooklyn Union is remarkably well held at 112 bid. Some observers say 'tis time to look for another dividend on these shares. The gas share market in general is strong, and if well-advised speech counts for anything, cognizance should be taken of advices to purchase Consolidated "at the market."

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 8.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y City Companies.	*Capital.*	*Par*	*Bid*	*Asked.*
Consolidated	$73,177,000	100	123	123¼
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual	3,500,000	100	130	160
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	92	96
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98	104
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	90	98
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	112	120
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	999,650	500	120	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1	1 1-16
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	a,250,000	1,000	63	66
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	90¼	90¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	87	88
Preferred	3,026,500	100	81	83
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,000,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	—	—	74½	75
Detroit City Gas Co.	6,000,000	50	—	50
" Prior Lien 5's	4,618,000	1,000	—	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Lt. Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	100	105
" Bonds, 5's	10,500,000	—	101	102½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	10	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	—	100
Preferred	2,500,000	100	80	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,870,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	54	54¼
Preferred	25,000,000	100	85	85¼
Montreal, Canada	2,000,000	100	218	218½
Nashville Gas Lt. Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	24,000,000	100	91¾	92
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Elec. Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	103½
San Francisco, Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	92	—
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¼	115
General Mortgage, 5's	2,465,000	1,000	96¾	—
Syracuse, N. Y.	1,375,000	100	50	55
Bonds	2,047,000	1,000	102	—
Washington, D. C.	2,000,000	20	346¼	353
1st Mortgage, 6's	600,000	—	—	—
Western, Milwaukee	4,000,000	—	—	—
Wilmington, Del.	600,000	50	220	—

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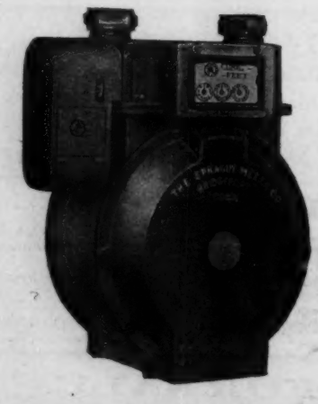

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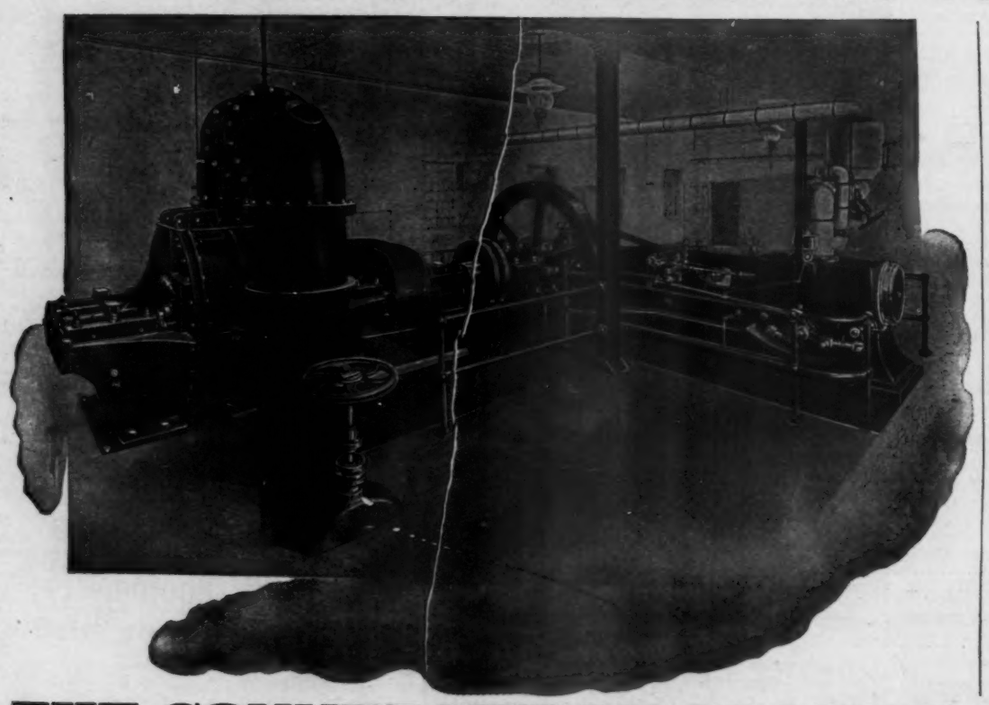

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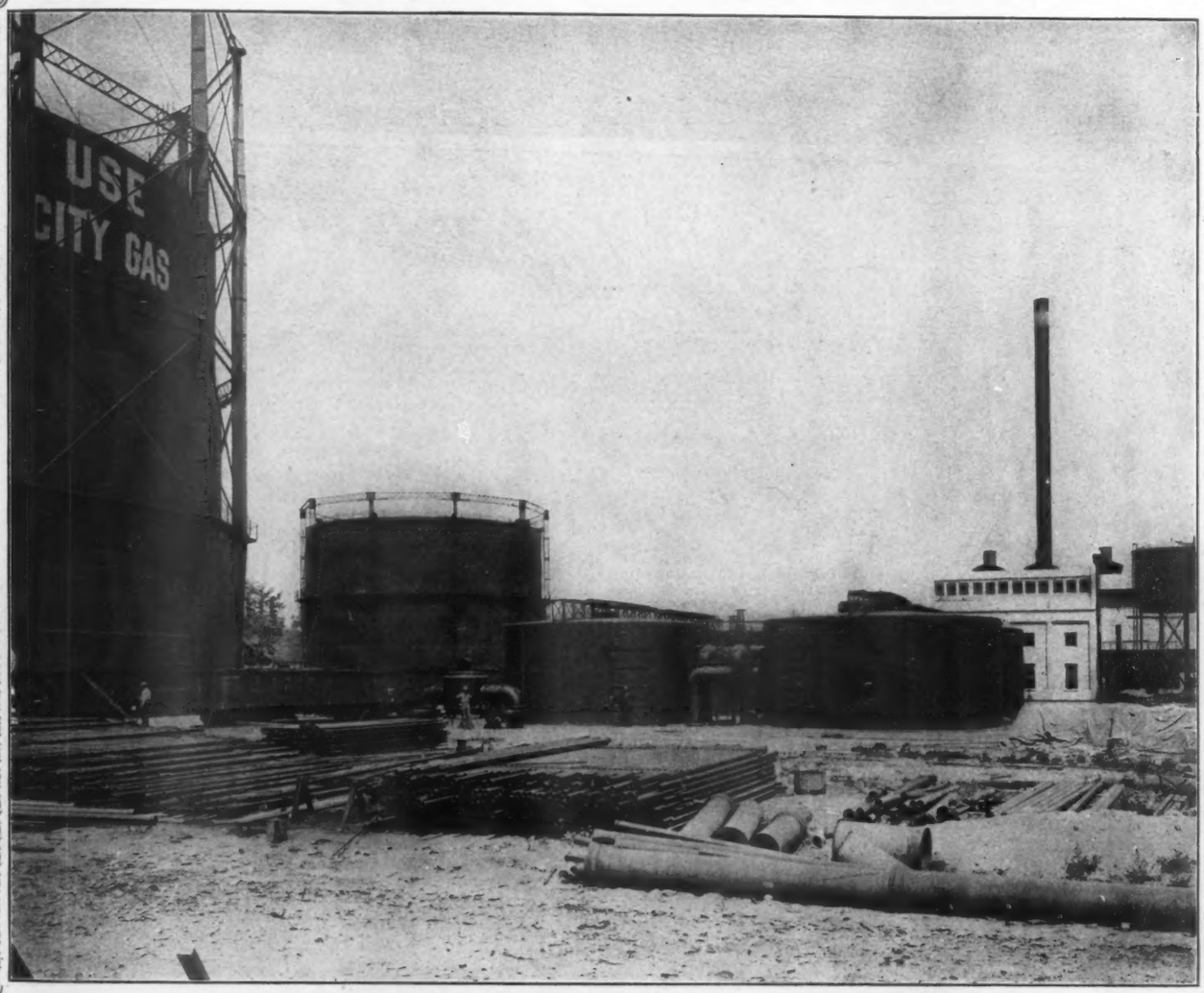

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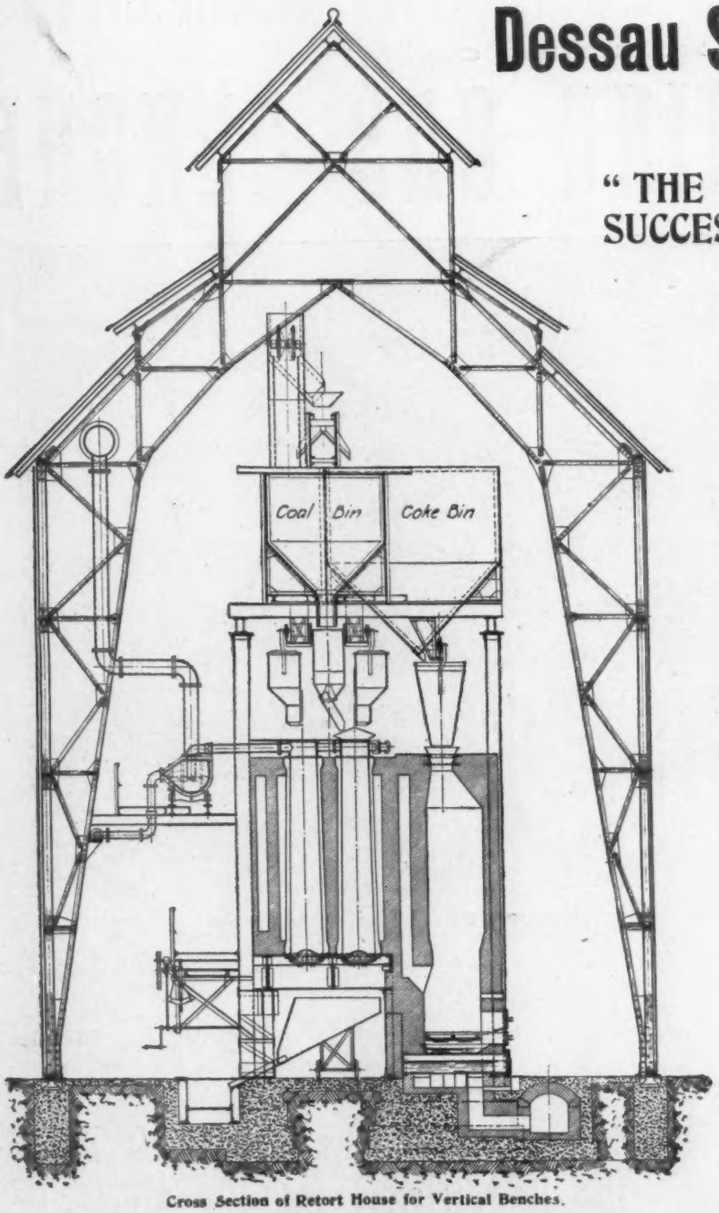

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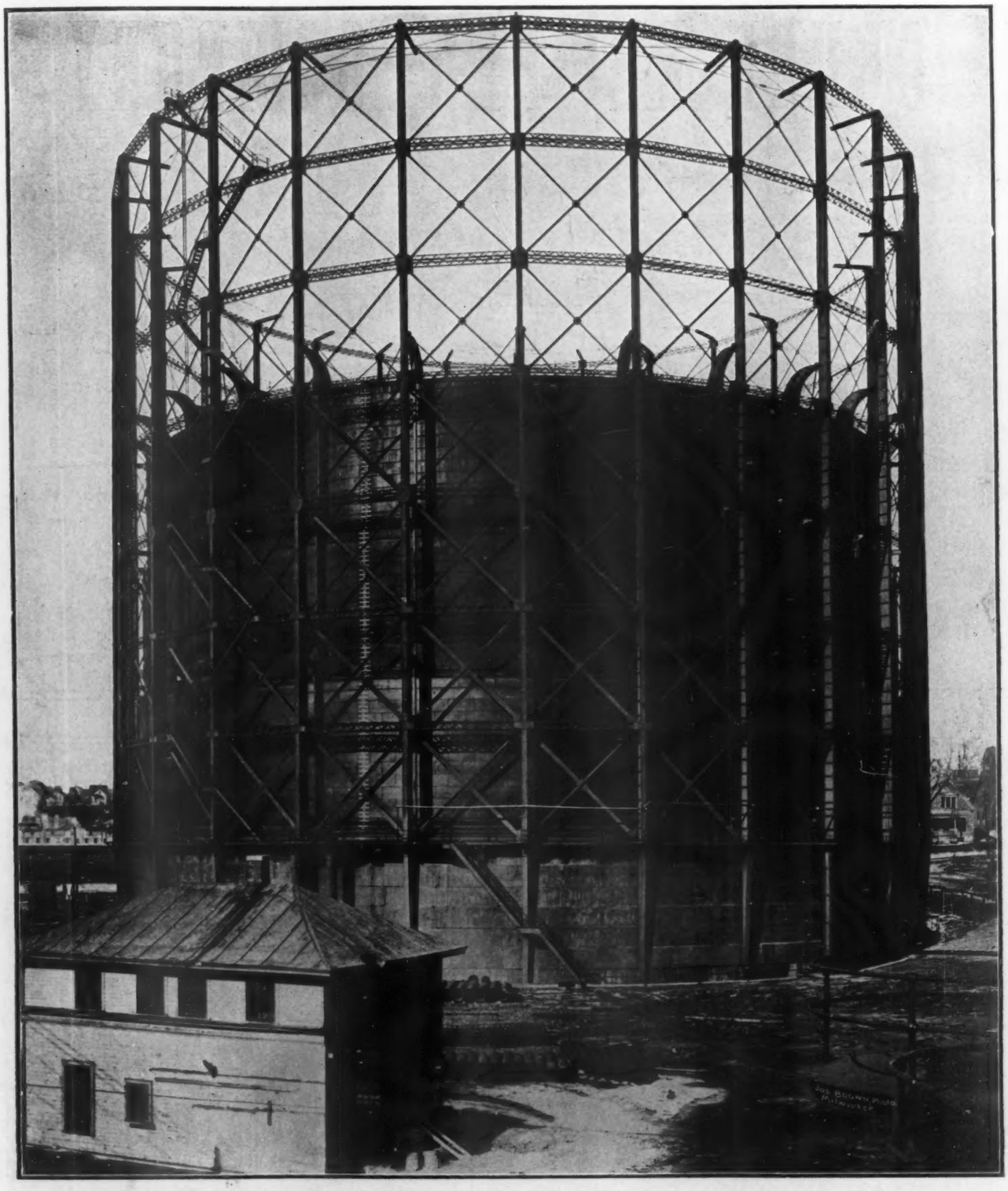

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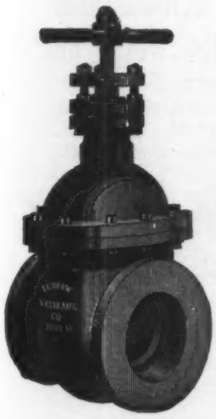

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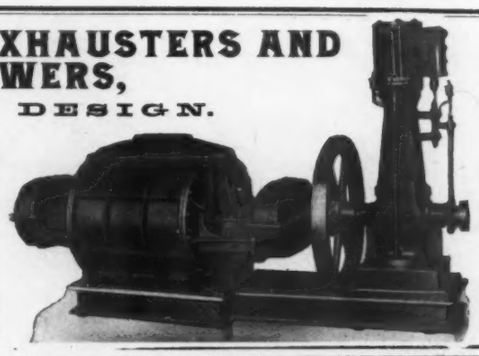

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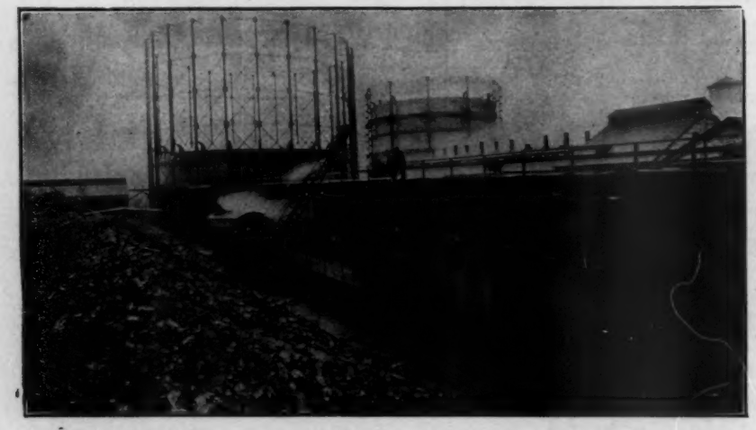

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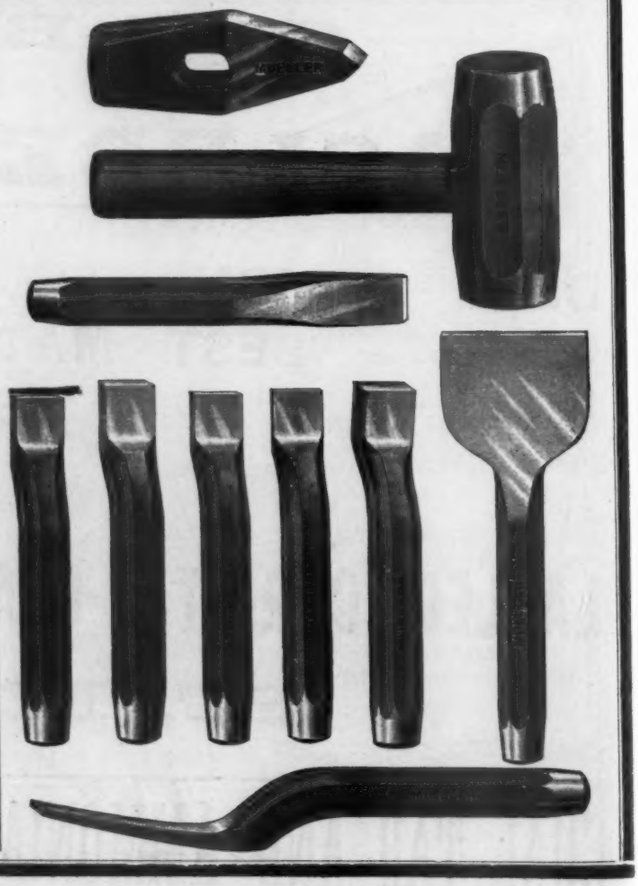

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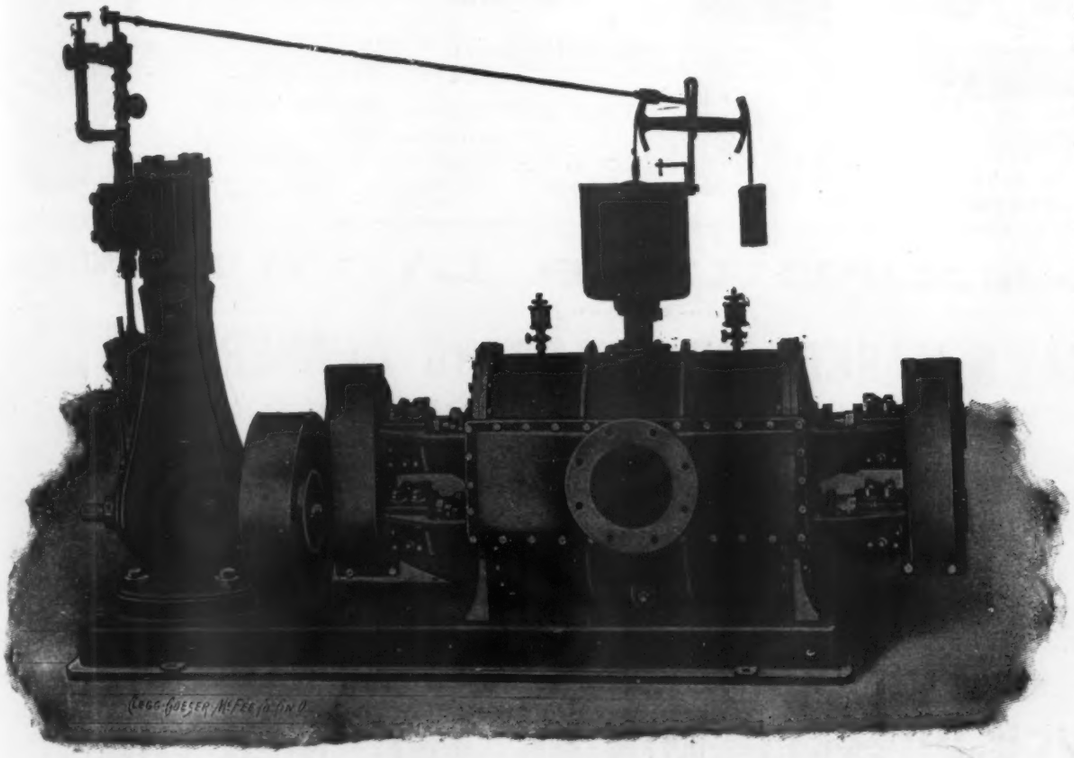

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

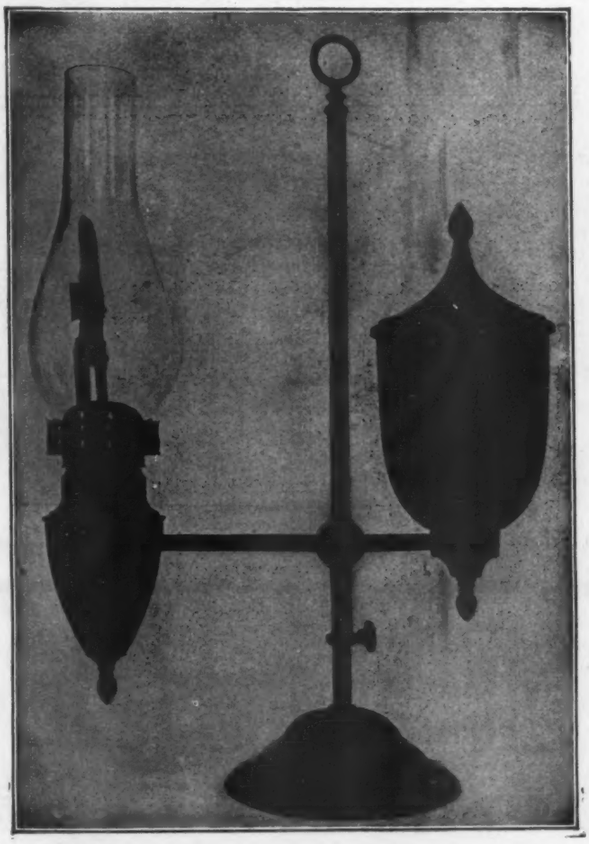
JUNE, 1908.

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Mon.	1	7.50 PM	3.30 AM
Tue.	2	7.50	3.30
Wed.	3	10.20	3.30
Thu.	4	10.50	3.30
Fri.	5	11.20	3.30
Sat.	6	11.50 FQ	3.30
Sun.	7	12 20 AM	3.30
Mon.	8	12.40	3.30
Tue.	9	1.10	3.30
Wed.	10	1.40	3.30
Thu.	11	2.10	3.30
Fri.	12	2.50	3.30
Sat.	13	No L.	No L.
Sun.	14	No L. FM	No L.
Mon.	15	No L.	No L.
Tue.	16	8.00 PM	10.50 PM
Wed.	17	8.00	11.40
Thu.	18	8.00	12.20 AM
Fri.	19	8.00	1.00
Sat.	20	8.00 LQ	1.30
Sun.	21	8.00	2.00
Mon.	22	8 00	2.20
Tue.	23	8.00	2.50
Wed.	24	8.00	3.20
Thu.	25	8.00	3.30
Fri.	26	8.00	3.30
Sat.	27	8.00	3.30
Sun.	28	8.00 NM	3.30
Mon.	29	8.00	3.30
Tue.	30	8.00	3.30

TOTAL HOURS DURING 1908.

By Table No. 1.

	Hrs.Min.
January	228.30
February	187.30
March	192.00
April	160.10
May	155.10
June	138.00
July	155.50
August	173.40
September	185.20
October	214.00
November	218.10
December	226.40
Total, yr.	2235.00



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10-Candle Power.

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This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

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2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

JUNE, 1908.

Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Complete Lighting in One Hour From Time Given P. M.	Complete Extinguishing in 50 Minutes From Time Given A.M.
Mon.	1	7.12	3.17
Tue.	2	7.12	3.17
Wed.	3	7.12	3.17
Thu.	4	7.17	3.12
Fri.	5	7.17	3.12
Sat.	6	7.17	3.12
Sun.	7	7.17	3.12
Mon.	8	7.17	3.12
Tue.	9	7.17	3.12
Wed.	10	7.17	3.12
Thu.	11	7.17	3.07
Fri.	12	7.17	3.07
Sat.	13	7.17	3.07
Sun.	14	7.17	3.07
Mon.	15	7.17	3.07
Tue.	16	7.17	3.07
Wed.	17	7.17	3.07
Thu.	18	7.22	3.07
Fri.	19	7.22	3.07
Sat.	20	7.22	3.07
Sun.	21	7.22	3.07
Mon.	22	7.22	3.07
Tue.	23	7.22	3.07
Wed.	24	7.22	3.07
Thu.	25	7.27	3.07
Fri.	26	7.27	3.07
Sat.	27	7.27	3.07
Sun.	28	7.27	3.07
Mon.	29	7.27	3.07
Tue.	30	7.27	3.07

TOTAL HOURS DURING 1908.

	Hrs.Min.
January	481.50
February	329.15
March	351.50
April	341.50
May	233.05
June	218.10
July	282.55
August	254.55
September	292.25
October	420.45
November	374.30
December	411.05
	3992.35
Deduct on account of 50 min. extinguishing time	30.30
Total, yr.	3962.05

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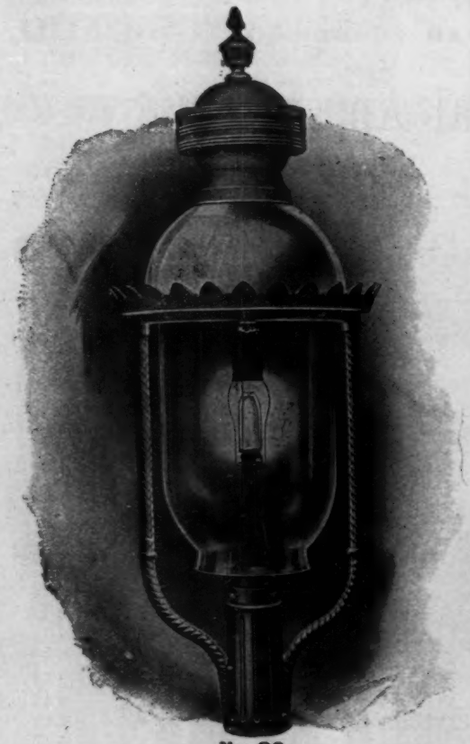

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TOTAL SETS INSTALLED DURING YEAR, ... 43
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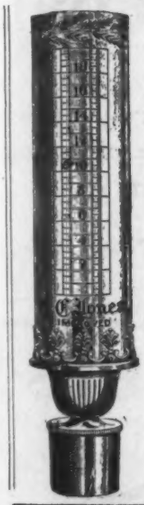

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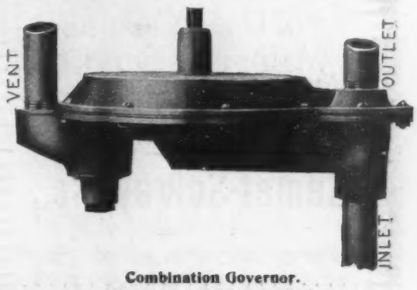

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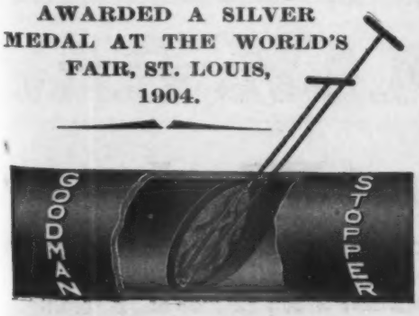

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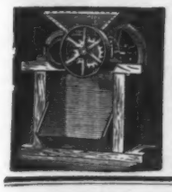

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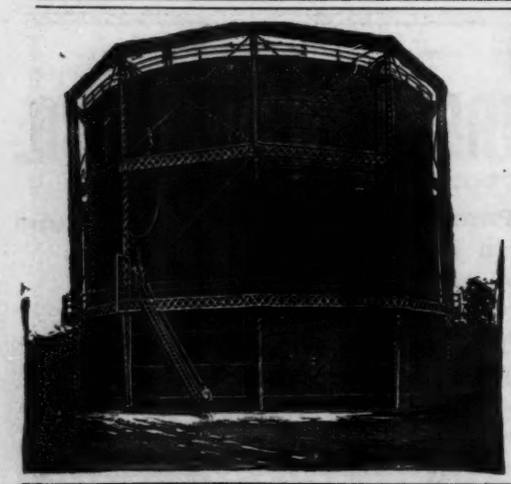

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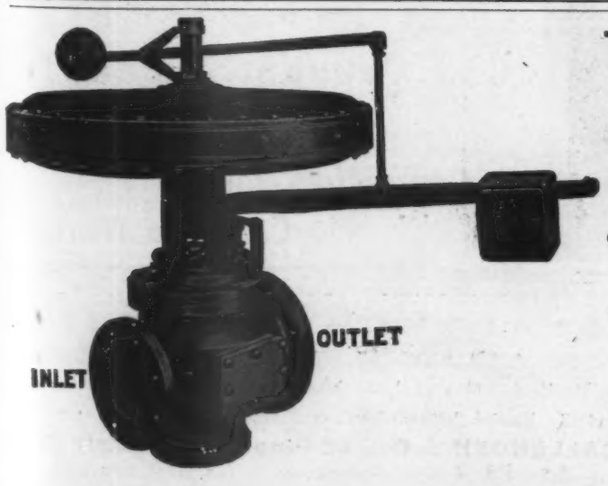

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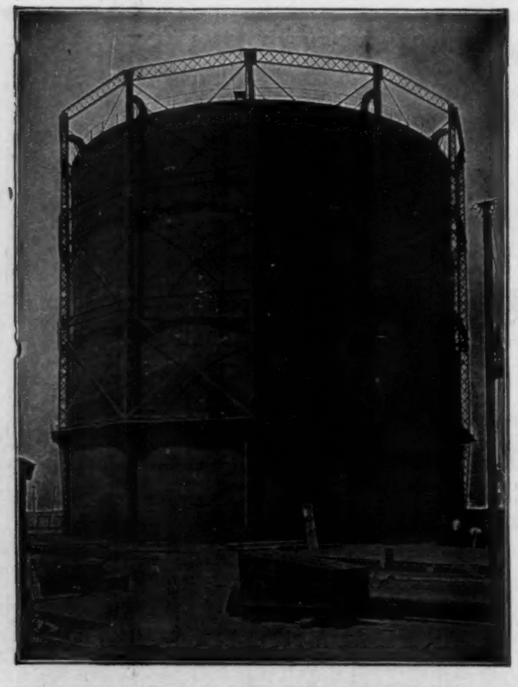

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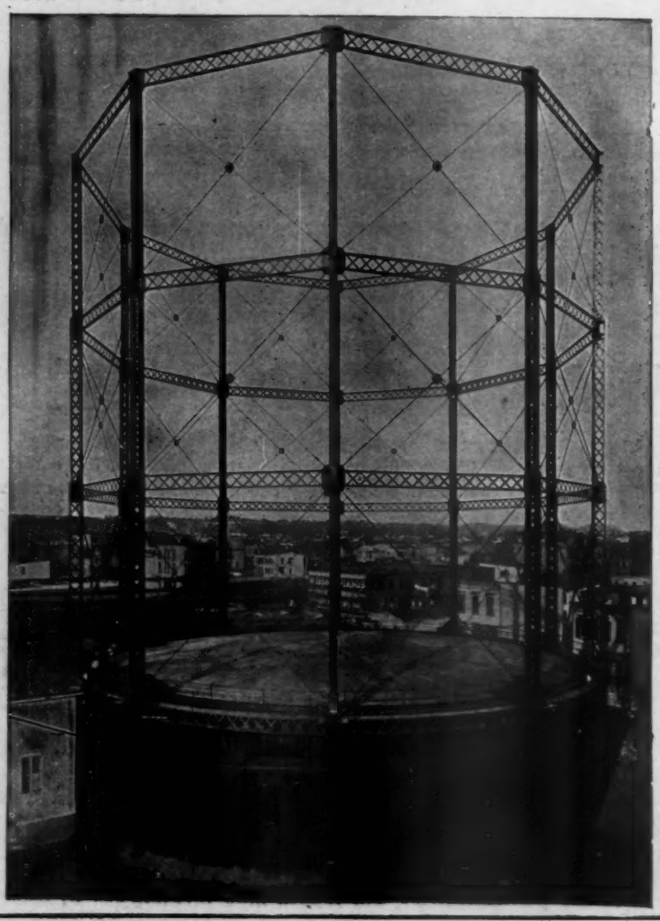

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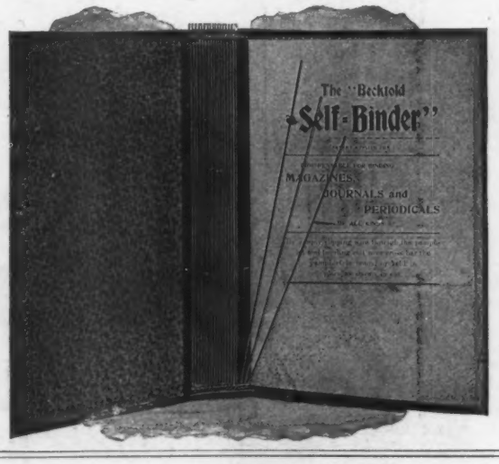

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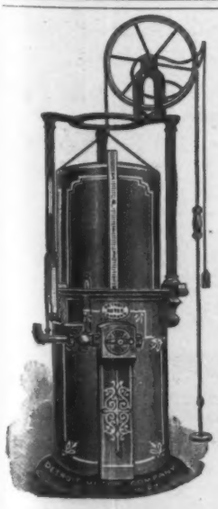

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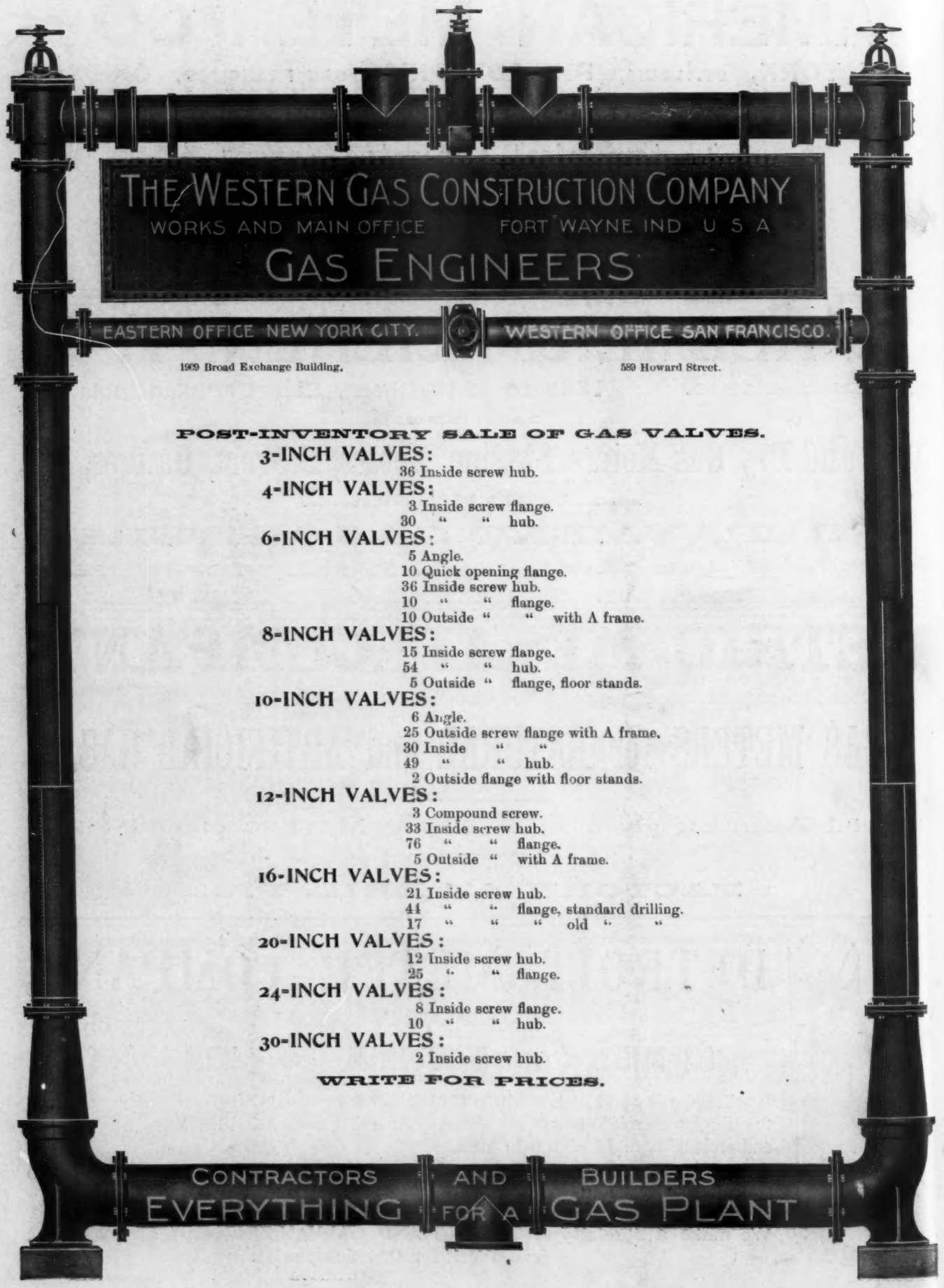
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